

ELEVEN MENTAL TESTS
STANDARDIZED

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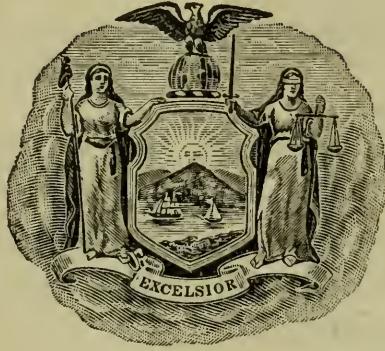


Waverley, Massachusetts

No. 413-30

STATE OF NEW YORK
STATE BOARD OF CHARITIES

DEPARTMENT OF STATE AND ALIEN POOR



THE BUREAU OF ANALYSIS AND INVESTIGATION

Eleven Mental Tests Standardized

EUGENICS AND SOCIAL WELFARE BULLETIN
No. V

THE CAPITOL, ALBANY, NEW YORK
1915

THE STATE BOARD OF CHARITIES
1915

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ABBREVIATIONS

Albany — Albany Orphan Asylum, Albany, N. Y.

Hudson — New York State Training School for Girls, Hudson, N. Y.

Newark — State Custodial Asylum for Feeble-Minded Women, Newark, N. Y.

Rome — Rome State Custodial Asylum, Rome, N. Y.

St. Vincent's — St. Vincent's Male Orphan Asylum, Albany, N. Y.

Troy — Troy Orphan Asylum, Troy, N. Y.

Mental age is given in Roman numerals, e. g. IX = nine years mentally. Physical age, used interchangeably with chronological age, is given in Arabic numerals, e. g. 9 = nine years physically.

Time is given in minutes (') and seconds (").

References to the bibliography are by number, e. g. (7).

FOREWORD

The work reported in this bulletin has been in progress for two years, under the immediate guidance of Dr. Gertrude E. Hall, director in charge of the Bureau of Analysis and Investigation. Four investigators gathered the material and it was then reduced to statistical form by Investigator Marion Collins who is responsible for the tables and for most of the text. The conclusions are found on pages 16-17.

ROBERT W. HILL,
Superintendent of State and Alien Poor.

The Capitol, Albany, N. Y., June 1, 1915.

INTRODUCTION

The connection of the Bureau of Analysis and Investigation with the problems of psychology is established in the rules adopted in 1911 by the State Board of Charities for the guidance of the Bureau in its work. Three of the ten purposes of the Bureau are here quoted:

“To inform and aid the local officers in the execution of their duties connected with those whose dependency is due to defectiveness.

“To get light on the causes of defectiveness.

“To provide an accurate estimate, census, and permanent record of defectiveness in the State of New York, in order to inform officials and the public as to the need of further legislation and of further institutional provision for these classes.”

These purposes are to be pursued so far as practicable by the following methods (two out of six sections quoted):

“By carrying on field work through special investigators studying the conditions of defectives already in institutions and of applicants for admission.

“By carrying on the necessary special psychological studies into the mental condition of defectives in institutions and schools.”

In short the determination of the nature and causes of mental defectiveness requires of the Bureau at every step the application of the principles of psychology and since the method of their application is as yet only partially developed, it devolves upon the Bureau partly to develop its own criteria and thus aid in the standardization of the tests which are applicable to its work.

A few psychologists claim that psychology is so undeveloped that its use for diagnosis of mental traits or for other practical purposes is unsafe. On the other hand Münsterberg says (7, p. vii):

“ The time seems ripe for bringing the psychological work into full contact with the practical efforts of civilization. The application of psychological studies to education and law, to industry and commerce, to health and hygiene, to art and science, deserves its place in the psychological curriculum. . . . The processes which result from the social contact have traditionally been neglected, because individual psychology had to reach a certain completeness before the scientific interest could turn to social consciousness. But our day, which has seen the ripening of applied psychology, has brought us also to the rapid growth of social psychology, and its outlines ought to be drawn in any map of the psychological world.”

A good beginning in the practical application of psychology has been made by investigators in Europe and America, but for diagnostic purposes probably the most useful contribution is the Binet-Simon Measuring Scale for Intelligence, which has been heralded as the dawn of a new era. Its enthusiastic reception has, however, been accompanied by criticism and this has led to the conclusion that the tests above ten years are less successful than those for the lower years, and that alternate questions are needed to parallel the whole series. The Binet-Simon tests used in the present study were a slightly modified 1908 form at first, and later the 1911 American revision. It is believed that the final grading from the two blanks is approximately the same, except that the greater number of questions above XI in the latter permits higher scoring. Discussion of the value of the Binet-Simon tests is deferred until a larger body of data shall have been gathered.

In the choice of other tests the Bureau was influenced by its own peculiar needs: (1) Its work is state-wide and not confined to a permanent laboratory, hence its apparatus must be simple and portable; (2) the State Board of Charities deals partly with deaf-mutes, the blind and foreign-speaking people, therefore some of the tests must be independent of the use of language and of vision. The tests selected were:

Test	Author or designer	Bibliographical references
Form-board.....	Seguin.....	Goddard (2) Sylvester (10) Wallin (11) Whipple (13)
Construction test A.....	Healy and Freeman.....	Healy and Fernald (5) Knox (6)
Construction test B.....	Fernald and Healy.....	Healy and Fernald (5) Knox (6)
Drinking cup.....	Bureau of Analysis and Investigation	
Motor coördination.....	Healy and Whipple.....	Healy and Fernald (5)
Cancellation.....	Woodworth and Wells...	Fernald (1) Whipple (12) Woodworth and Wells (14)
Recognition memory.....	Fernald.....	Fernald (1)
Aussage*.....	Binet.....	Healy and Fernald (5) Whipple (12)
Pictorial completion.....	Healy.....	Healy (4)
Telling time.....	Bureau of Analysis and Investigation	
Antonyms†.....	Thorndike.....	Healy and Fernald (5)

* A German word meaning *statement*.

† Words directly opposed to others in meaning.

Material.—The materials used were uniform, and were purchased from the supply houses which prepare psychological material, in so far as they could be so purchased. A full description is given under each test.

SCHEDULE A

PHYSICAL AGE DISTRIBUTION OF PERSONS TESTED

PHYSICAL AGE	NUMBER TESTED							Total
	Newark	Rome	Troy	Albany	Hudson	St. Vincent's	Public school	
5.....			3			1		4
6.....		1	22	11		17		51
7.....			23	10		19	30	82
8.....			24	14		22	30	90
9.....		1	22	19		29	30	101
10.....		3	24	24		34	30	115
11.....		1	29	18		32	30	110
12.....			23	14	1	40	30	108
13.....		4	20	15	7	38		84
14.....		7	11	4	12	42		76
15.....		8	5	4	26	25		68
16.....	1	16	2	1	40	6		66
17.....	4	11	2		49			66
18.....	4	12			35			51
19.....	11	13			23			47
20.....	15	9			15			39
21.....	9	7						16
22.....	10	11						21
23.....	9	5						14
24.....	6	8						14
25.....	10	7						17
26.....	8	5						13
27.....	22	3						25
28.....	3	6						9
29.....	8	4						12
30.....	11	3						14
31.....	4	4						8
32.....	11	1						12
33.....	5	1						6
34.....	3							3
35.....	3	3						6
36.....	2	2						4
37.....	3							3
39.....	2							2
40.....	1							1
41.....		1						1
44.....		1						1
46.....		2						2
47.....	1	2						3
Total.....	166	162	210	134	208	305	180	1,365

The Subjects.—Thirteen hundred and sixty-five persons were tested, ranging in age from five to forty-seven years, as shown in Schedule A. The data were gathered from six institutions and from one selected group of public school children in the following order:

1. STATE CUSTODIAL ASYLUM FOR FEEBLE-MINDED WOMEN, NEWARK, N. Y.

Here the details of the method were worked out, the 1908 form of the Binet-Simon test being used and all the other tests except motor coördination and telling time. From a population of about 790, 166 of the brighter and for the most part younger inmates

were tested. As all the subjects had previously been diagnosed as feeble-minded, the purpose of the work was to study the efficacy of the tests and the reactions of mental defectives to them.

2. ROME STATE CUSTODIAL ASYLUM, ROME, N. Y.

The cases were selected to form a group of males comparable to the females at Newark. The age distribution shows a wider range than at Newark (Schedule A), with more than half of the cases under 20. The same tests as at Newark were used with the exception of the pictorial completion test.

3. PUBLIC SCHOOL, ALBANY, N. Y.

This school draws from one of the best residential sections in the city although on the outskirts of its territory are several poorer streets and a "hollow". Thirty children of each age from 7 through 12 were tested with the complete list except motor coördination and telling time; the children selected were those who were considered normal in their school work, and had been promoted at the beginning of the school year; and classification was made by physical and not mental age. As a control experiment this did not fulfill expectations as in almost every test the 9 year old children show a better average than those 10 years old, and the 12 year old children are no better than those of 11 years.

4. TROY ORPHAN ASYLUM, TROY, N. Y.

In this modern, well-conducted institution on the congregate plan, all the children over 5 were tested, also 3 who were 5 years old, a total of 210 children. They were given the 1908 Binet-Simon tests, and all the others except construction test A. The purpose was double, (a) a further study of the tests, (b) a study of orphan asylum children.

5. ALBANY ORPHAN ASYLUM, ALBANY, N. Y.

This orphan asylum is built on the cottage plan, and the life of the children approaches that of the normal home. All the children 6 years of age or over were tested, 134 in all. The same tests were used as at Troy, except that very early in the work the 1911 American revision of the Binet-Simon tests was put in

use. The object of the work was dual, as in Troy, to test the tests and to study the children.

6. NEW YORK STATE TRAINING SCHOOL FOR GIRLS, HUDSON, N. Y.

This school receives upon court commitment girls not over 16 years of age. Here the data on the tests were secondary, as the work was primarily for the mental diagnosis of girls who failed to profit as they ought by the training of the school. In all 208 girls, ranging in age from 12 to 20 years were tested, at three different times, during which both forms of the Binet-Simon scale and all the other tests were used.

7. ST. VINCENT'S MALE ORPHAN ASYLUM, ALBANY, N. Y.

In this congregate institution for boys there is a tendency to keep the boys longer than in the other two orphan asylums, as shown in Schedule A. As the testing was done at two different times 305 children were included, a few more than were actually there at one time. The full series of tests was used with the 1911 form of the measuring scale.

The Examiners.—Four investigators of the Bureau of Analysis and Investigation gave the tests; all worked under the same directions and conscientious effort was made to have the work uniform. The assignments of work and the number of cases contributed by each are shown in Schedule B. It will be noted that in four of the groups two or more investigators are responsible for the results, while three institutions were done, each by a different investigator.

SCHEDULE B

SHOWING THE DISTRIBUTION OF WORK AMONG THE INVESTIGATORS

INVESTIGATOR	Newark	Rome	Public school	Troy	Albany	Hudson	St. Vin- cent's	Total
Bingham.....	36	162	74	.....	.....	18	.....	290
Collins.....	130	.....	106	199	.....	77	.....	512
Conway.....	.....	.....	.....	11	134	.....	.....	145
Herrick.....	.....	.....	.....	.....	.....	113	305	418
Total.....	166	162	180	210	134	208	305	1,365

The work in each institution and school was conducted in a quiet, pleasant room, free from interruptions, a table and two chairs being the only essential furniture. The score sheet, shown in Schedule C, was set up on the multigraph with generous spacing for the records and revised to meet any variation in the requirements. The antonyms were printed on the Binet-Simon blanks.

SCHEDULE C

STATE BOARD OF CHARITIES

DEPARTMENT OF STATE AND ALIEN POOR — BUREAU OF ANALYSIS AND
INVESTIGATION

NAME		WHERE EXAMINED		
DATE	PHYSICAL AGE	MENTAL AGE	SCHOOL GRADE	
FORM-BOARD				
1st Time	2nd	3rd		
CONSTRUCTION TEST A	Time	Moves		
CONSTRUCTION TEST B	Time	Moves		
DRINKING CUP	Time	Moves		
MOTOR COÖRDINATION	1st Squares	Errors	Efficiency	
	2nd Squares	Errors	Efficiency	
CANCELLATION	Time	Errors		
RECOGNITION MEMORY	Chosen	Correct	Errors	
AUSSAGE				
Response — Enumerative		Descriptive	Interpretative	
Details — No. correct from free recital				
No. correct from questioning				
No. erroneous				
No. imagined				
Suggestibility	Not suggestible	Somewhat suggestible	Very suggestible	
PICTORIAL COMPLETION	Errors	Reasonable	Not reasonable	
TELLING TIME	1	2	3	4

The Function of Mental Tests.—At best mental tests are merely instruments for the analysis of mental capacity, and consequently the reaction to a test is always more significant than the mere fact of success or failure. For example the statement that Mary Smith succeeded in making the drinking cup shows that she was able to follow the five directions, but if a note follows: “She failed to make the drinking cup on the first trial because of poor attention to directions, but was resourceful enough to detect and correct her mistake by observing the finished product on the table,” it

indicates the quality of her power of attention and her ability to perceive an error and correct it. The analysis of the reaction requires both skill and experience on the part of the examiner. Any person with an ordinary amount of intelligence and sufficient tact to persuade the subject to coöperate can apply the tests according to printed directions, and record the fact of success or failure; but this is not sufficient, for practically the whole value of the work is lost unless the investigator has keen powers of observation, an analytical mind, a background of experience, and the human sympathy and constructive imagination to interpret correctly the thought and emotional life of the subject.

Laboratory examination is not the only way of testing persons to decide whether or not they are feeble-minded, but it is the quickest way and when it is further developed should be by far the most precise. It requires no special effort after prolonged contact, for those familiar with the traits of feeble-mindedness to tell whether or not a person is mentally deficient, but when a person is before a committing officer, or in many other exigencies, it may be desirable to know immediately his mental ability, and to attain this knowledge quickly and accurately requires the use of standardized tests and laboratory methods. A laboratory experiment succeeds if it enables the investigator to determine within a practical length of time the mental development and general character of a person, which under ordinary circumstances could be interpreted accurately only after prolonged acquaintance.

Treatment.—A chapter is devoted to each of the eleven tests, in which the material is described, the method of presentation given, typical reactions cited and the method of scoring illustrated. The tabulation of data varies somewhat from chapter to chapter, for the effort was always made to present only those tables which throw light on the test. So large a number of the persons tested were backward or feeble-minded, that the tabulation of the data by physical ages alone would be misleading; hence the classification by mental ages was used. The change from the 1908 to the 1911 form of the Binet test is unfortunate as regards absolute precision, but probably this was more than compensated in the accuracy of the results, by the opportunity afforded the older

children who were tested last, especially the St. Vincent's Male Orphan Asylum cases, to attain, if they were able, a mental age more nearly approximating their physical age. The results of each institutional group are given, and where these correspond for given mental or physical ages, it is considered an evidence of the reliability of the test. The Newark, Rome and Troy averages by mental ages are based on the 1908 Binet-Simon tests, the Albany and St. Vincent's on the 1911 form, and the Hudson averages on both. In those tests, notably motor coördination, in which the results appear to depend more upon physical than on mental development, the data are arrayed on a physical basis. Each chapter closes with a judgment as to the value of the test.

Schedule D shows the subjects classified according to their mental ages. As the school children were not given the Binet-Simon tests they are omitted from this schedule. A summary of the tests concludes the introduction.

SCHEDULE D

MENTAL AGE DISTRIBUTION OF PERSONS TESTED

MENTAL AGE	Newark	Rome	Troy	Albany	Hudson	St. Vincent's	Total
IV.....	6	4	1	.....	.....	1	12
V.....	5	8	12	4	.....	8	37
VI.....	11	10	15	7	.....	20	63
VII.....	17	33	26	18	2	51	147
V II.....	40	39	24	23	11	45	182
IX.....	44	44	46	26	31	61	252
X.....	26	11	41	23	52	40	193
XI.....	14	8	29	17	56	35	159
XII.....	3	5	7	13	31	10	69
XII+.....	.....	.....	9	3	12	33	57
XV.....	.....	.....	.....	.....	13	1	14
Total.....	166	162	210	134	208	305	*1,185

* 180 school children were not given the Binet-Simon tests and hence are not included in this schedule.

SUMMARY OF THE TESTS

1. THE FORM-BOARD:

Imbeciles are noticeably slower than young children of corresponding mental age.

As a special age test it indicates a IX year mentality when done in 18 seconds.

2. CONSTRUCTION TEST A:

Normal 9 year old children should succeed with it.

3. CONSTRUCTION TEST B:

Success may be expected from normal 11 year old children or from an XI year mentality.

5. DRINKING CUP:

Normal 10 year old children should succeed with it. A few children know how to fold it.

5. MOTOR COORDINATION:

Success depends upon physical as well as mental development.

At 12 years the normal child should make a record of 60 squares.

At 17 years one should tap 80 squares with not more than 2 errors.

6. CANCELLATION:

A child of 11 years should do the test in 2 minutes with not more than 1 error.

At 13 years the time should be lowered to 1½ minutes.

7. RECOGNITION MEMORY:

The test in the form used by the Bureau is too hard.

8. AUSSAGE:

Young children confine themselves to enumeration, older children give description and children over 12, interpretation.

For children over 9 years of age it is useful for gauging suggestibility.

Feeble-minded children are more suggestible than normal children of corresponding mental age.

9. PICTORIAL COMPLETION :

Normal children succeed better than defective children of the same mental age.

In general mental defectives do not succeed with it.

10. TELLING TIME :

Persons of XI year mentality know how to tell time, independently of special teaching.

11. ANTONYMS :

By the substitution of three easier words for the three hardest ones this should be distinctly a 12 year old test.

It calls for abstract thought which usually indicates mature mental development.

1. THE FORM-BOARD

Description of Test and Material.—The form-board used is of the standard type, a board $13\frac{1}{2}$ by $18\frac{1}{2}$ inches, recessed to hold 10 blocks of different geometrical design, $\frac{7}{8}$ of an inch in thickness, which project $\frac{3}{8}$ of an inch above the surface of the board (Figure 1). In referring to the board the system of numbering the blocks and their corresponding recesses beginning with the cross as number 1 has been used. A stop-watch is used for timing the reactions.

Method of Presentation.—According to Whipple, (13, p. 297) the correct method is to place the board, with the cross in the upper left-hand corner, on the table in front of the subject; and the blocks on the table at the right of the board in the following order:

	(2) triangle,	(4) circle,	(10) square,
(Board)	(7) lozenge,	(9) oval,	(6) hexagon,
	(5) oblong,	(8) star,	(3) half-circle, (1) cross.

The blocks are to be replaced in the order: 5, 8, 3, 1, 7, 9, 6, 2, 4, 10, using only one hand. Wallin (11, p. 74) placed the board in the same position but threw the blocks into a heap on the table at the top of the board. He told his subjects to use only one hand. After extended investigation Sylvester (10, p. 12) concluded that the blocks should lie in three piles at the top of the board with no block in the pile nearest its recess, the lozenge and the hexagon in different layers, and the star not at the top of any pile. The method used by the Bureau follows Goddard (2) and differs from those above in that the blocks are scattered at the right of the board within easy reach. The subject, standing at the front of the board, is told that there is a place for each block and that he is to put them in as quickly as he can; after trying one or two to learn the method he begins the first trial. He is then encouraged to believe that he can do it faster and is given two more trials. The time is recorded in each trial.

Typical Reactions.—In this test there is a difference between the performance of the normal and the feeble-minded child.

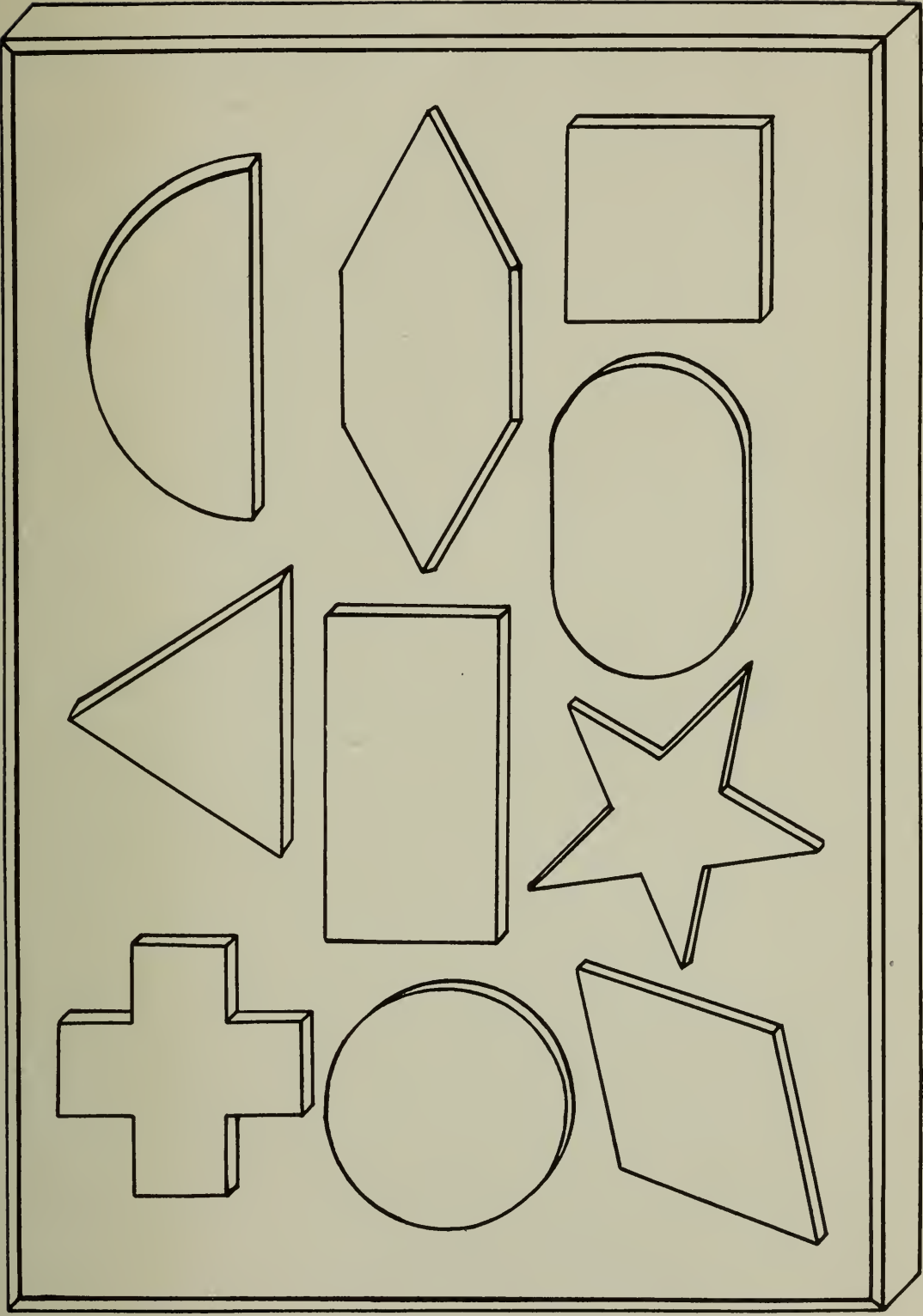


FIG. 1. THE FORM-BOARD

Bright young children work slowly and carefully, while defectives of the same mental age often manifest confusion and lack of reasoning, a quality which Sylvester grades as lack of "poise." A not unusual reaction is the attempt to crowd blocks by main force into impossible spaces; and the confusion of the star and the cross, due probably to a vague consciousness that both shapes are unusual, with a lack of differentiation between the two. The unusualness of the shape as well as a possible appeal to the aesthetic sense may account for the interest that these blocks excite, for either one or the other is almost invariably chosen by the defective for the first trial. It sometimes happens that the feeble-minded subject tries to place a form in its proper recess, but because of faulty manipulation the block is placed only with painful labor and after a long struggle. With morons as with normal persons the reactions indicate personal characteristics, from those who place the blocks without noise, confusion or false moves, to those who unthinkingly try the same block in many recesses before the correct one is found.

Method of scoring.—In scoring credit is given for the best time in three trials. In addition to the time, the number of false moves and the method of work are recorded. In two of the institutions the graphic method of recording used by Goddard, Whipple and Sylvester was employed. In this each block is numbered according to its position on the board. If the subject picks up number 2 and places it in the space for 2 the first line of the score sheet reads, "2-2." If, however, he attempts to put number 2 into the hole that belongs to number 8, then tries it in 3 and finally places it in 2, the record reads, "2-8-3-2." In this way all the blocks are recorded. A line that begins and ends with the same numeral denotes that the block has finally been placed correctly. If a block is tried in its proper hole but not fitted in, the move is recorded by 0, and if a block is removed after it has been placed the move is shown by a line drawn through the numeral. A low grade case might have a record for one block like "8-1-2-0-7-~~8~~-1-8," which signifies that after trying the star in the space for the cross, then in the one for the triangle, he tried it in its own space, but failing to get it in, tried it in the lozenge hole, then finally fitted it into the star space,

but afterward took it out, tried it again in the cross, put it back into its own space and left it there. The advantage of this method of scoring is that it furnishes a complete picture of the work done by the subject. If the examiner has in mind the number that is associated with each form and is accustomed to the use of the stop watch, both the time and the number of moves may be recorded without great difficulty.

Tabulation.—After an extended study Sylvester found that the average of the best time in three trials gave the smoothest curve and was therefore probably the best, but that for the picture of the individual child, his time and method of work for the first trial — without instructions — should be noted, and then, after any necessary instruction had been given, the shorter time of the next two performances recorded. This last method is practically the same as the first, since it is seldom that the first trial is better than either of the others. He also found that there is little improvement in the fourth or fifth trials, hence these may be disregarded.

The work of others is compared with the norms obtained by the Bureau. In Table 1 the average time of the normal children of Goddard, Sylvester and the Bureau are placed in juxtaposition, while in Table 2 is given the average time of the groups by Goddard, Wallin and the Bureau classified according to mental ages.

1. TABLE SHOWING AVERAGE TIME FOR FORM-BOARD TEST AT DIFFERENT CHRONOLOGICAL AGES

AGE	GODDARD'S NORMALS		SYLVESTER'S GROUP		BUREAU'S PUBLIC SCHOOL GROUP	
	Number tested	Average time	Number tested	Average time	Number tested	Average time
		<i>Seconds</i>		<i>Seconds</i>		<i>Seconds</i>
5.....	17	29.5	80	37.6	.....	.....
6.....	26	27.5	170	23.5	.....	.....
7.....	25	24.5	173	23.3	30	24.75
8.....	28	21.8	203	20.5	30	20.54
9.....	47	19.3	214	18.7	30	17.49
10.....	49	18.2	221	16.7	30	17.10
11.....	38	17.6	172	14.9	30	15.69
12.....	20	15.9	141	13.8	30	13.99
13.....	.....	.....	80	12.6	.....	.....
14.....	.....	.....	80	11.6	.....	.....
Total.....	250	.....	1,537	.....	180	.....

2. TABLE SHOWING AVERAGE TIME FOR FORM-BOARD TEST AT
DIFFERENT MENTAL AGES

MENTAL AGE	GODDARD'S				WALLIN'S GROUP		BUREAU'S GROUP	
	NORMALS		DEFECTIVES		Number tested	Average time	Number tested	Average time
	Number tested	Average time	Number tested	Average time				
		<i>Seconds</i>		<i>Seconds</i>		<i>Seconds</i>		<i>Seconds</i>
IV.....	7	33.8	53	76.12	12	110.6	11	79.90
V.....	7	30.3	52	51.25	8	84	32	53
VI.....	13	27.5	54	38.24	22	63.6	54	35.03
VII.....	47	25.4	85	26.39	32	32.5	126	24.57
VIII.....	43	20.7	87	23.80	54	25.5	164	19.99
IX.....	46	19.2	48	18.30	28	20.9	232	16.95
X.....	69	16.6	29	17.50	82	18.9	172	15.30
XI.....	25	15.9	8	16.40	27	16.1	145	14.04
XII.....	14	14.3	4	12	11	15	57	12.94
XII+.....	.....	.....	.....	.....	18	14.4	56	12.58
Total.....	371	.....	420	.....	294	.....	1,049	.....

In a footnote Sylvester (10, p. 54) states: "Formboard time records do not correlate well with Binet test results, children who are considerably retarded according to the Binet scale usually being more successful at the formboard test than are normal children of corresponding Binet age." In Table 3 the formboard records of 649 orphan asylum children are averaged in mental groups according to whether they are advanced, at age, or retarded. While the advanced children tend to take a little longer and the retarded children a little shorter time than the "at age" children for each mental age, the span of divergence is usually not greater than the difference between the "at age" average for a given group and that for the age just above and just below. In general the retarded children fall between the "at age" children of their group and those of the next older group, while the advanced children fall between the "at age" children of their group and the next younger "at age" group. The general averages for each age group fall so close to the "at age" averages for the same group, especially from VI to XII that it seems fair to assume a degree of correlation between the form-board time records and the Binet-Simon test results.

This conclusion is further sustained by comparing Sylvester's averages computed according to physical ages with the Bureau's averages computed on the basis of mental ages.

4. COMPARISON OF SYLVESTER'S AVERAGES BY PHYSICAL AGES WITH THE BUREAU'S AVERAGES BY MENTAL AGES

SYLVESTER'S GROUP		BUREAU'S GROUP	
Physical age	Form-board time	Mental age	Form-board time
5.....	37.6	V.....	*33.73
6.....	26.5	VI.....	*28.65
7.....	23.3	VII.....	24.57
8.....	20.5	VIII.....	19.99
9.....	18.7	IX.....	16.95
10.....	16.7	X.....	15.30
11.....	14.9	XI.....	14.04
12.....	13.8	XII.....	12.94
13.....	12.6	XII+.....	12.85

* The records of 33 imbeciles in Rome and Newark were omitted from the averages.

That normal children of the ages of 5 and 6 are much superior in their work to mental defectives of corresponding mental ages is demonstrated by the tables of Goddard and the averages of the Bureau. Goddard's normal children of the mental age of IV averaged 33.8'', his defective children 76.12''. The average for all the IV children of the Bureau was 79.9'', all of them being defectives. In the mental age V Goddard's normal children had an average time of 30.3'', the defectives of 51.25''. From the records of the Bureau when the groups from Rome and Newark are separated from the orphan asylum children, the time of the normal children is 33.73'', compared to 30.3'' of Goddard and 37.6'' for Sylvester's normal children; the averages of the Rome and Newark groups of the same ages are 60.98'' compared to Goddard's 51''. In VI Goddard's normals are 27.5'', the Bureau's 28.65'', Sylvester's 26.5'', while the defectives are, Goddard's 38.24'', the Bureau's 45.9''. Beyond VI there is enough similarity in the results to lead to the conclusion that this difference no longer exists.

Not only is it desirable to know the averages for each age, but the amount of variation which may be expected. The average and standard deviations are given in Table 5.

5. AVERAGE TIME, AVERAGE DEVIATION AND STANDARD DEVIATION FOR EACH MENTAL AGE

MENTAL AGE	Average time	Average deviation	Standard deviation
V.....	33.73	7.33	11.76
VI.....	28.65	5.74	10.83
VII.....	24.57	5.76	8.32
VIII.....	19.99	3.92	5.57
IX.....	16.95	3.18	4.18
X.....	15.30	2.27	3.05
XI.....	14.04	2.30	2.79
XII.....	12.94	1.85	2.61
XII+.....	12.58	1.22	1.26
XV.....	12.66	2.39	3.00

For V and VI the orphan asylum averages are used, excluding the averages from Rome and Newark. These are compared with Sylvester's in Table 4.

In Table 6 is given the range of performance based upon the standard deviations.

6. EXPECTATIONS FOR FORM-BOARD TIME AT EACH MENTAL AGE

MENTAL AGE	From	To
	<i>Seconds</i>	<i>Seconds</i>
V.....	21.97	45.49
VI.....	17.82	39.48
VII.....	16.25	32.89
VIII.....	14.42	25.56
IX.....	12.77	21.13
X.....	12.25	18.35
XI.....	11.25	16.83
XII.....	10.33	15.55
XII+.....	11.32	13.84
XV.....	9.66	15.66

If it is desired to use the form-board as a special age test, it seems properly to be a test of IX mentality when done in 18". The figures to support this view are:

1. The average time for 649 orphan asylum children was 18.4".

2. The average time of 9 year old children with IX year mentality was 18.3".

3. The average time for 9 year old public school children was 17.49".

4. Sylvester's 9 year old group averaged 18.7".

5. Goddard's IX year defectives averaged 18.3".

6. The Bureau's average for 232 subjects with IX mentality was 16.95".

Value of the Test.—There seems to be no disagreement among the clinical psychologists as to the value of the form-board in giving insight into the mental ability of the subject; on the other hand there seems to be little agreement as to what qualities the test measures. The reaction to the test, simple as it appears, involves form perception, coördination of hand and eye muscles and some ability to plan. It has been used to study method of approach and improvement by practice. Sylvester points out that a quality which he chooses to call "poise" is demonstrated. A point in favor of the test is its independence of formal educational advantages and of language. It is especially valuable in diagnostic work with young children where the Binet-Simon scale furnishes scanty means for classification; as a game with which to get acquainted with a child or a self-conscious older person it plays a valuable role.

2. CONSTRUCTION TEST A

Description of Test and Material.—Construction test A is described by Healy (5) for whom it was sketched by Prof. F. N. Freeman, and is also used by Knox (6). Five rectangular blocks of different sizes but of the same thickness, some of which are interchangeable, fit into a rectangular frame, the inside measurements of which are 3 inches by 4 inches.

Method of Presentation.—No directions are given further than that the pieces, which are scattered about on the table, will all go into the frame and exactly fill it.

Typical Reactions.—In general the reactions to construction test A fall into three classes:

1. Prompt fitting of all of the pieces into the space, the result of a definite plan.
2. Trial and error method which may or may not result in success; success may be as prompt as in the first method, if by a fortunate chance the first and second pieces fall into their correct positions.
3. Complete failure.

In many cases the subject finds, after one or two trial moves, that the largest piece will fit exactly along the end of the frame; pleased with his success he then tries the next largest piece in a parallel position. The alert individual, conscious that this move, since it leaves a small space between the edge of the frame and the block, is not in accordance with directions, rejects it. If he then places this piece correctly he is in a fair way to succeed, but if not he may make a number of random moves, he may begin all over again, or he may give up. Imbeciles are sometimes content to crowd some of the pieces into the frame on edge to get them all in, or to continue indefinitely in the repetition of purposeless moves. Even with the most aimless trial and error method, subjects sometimes persevere long enough to succeed.

The purpose of the test is to show perception of form and method of work. Although there are, of course, individuals whose

8. NUMBER OF SCHOOL CHILDREN TESTED, NUMBER AND PER CENT. SUCCESSFUL, AVERAGE TIME AND AVERAGE NUMBER OF MOVES

AGE	Number tested	Number successful	Per cent. successful	Average time	Average number of moves
7.....	30	15	50.0	<i>Seconds</i> 126.8	26.5
8.....	30	16	53.3	133.5	34.1
9.....	30	29	96.6	95.9	25.0
10.....	30	27	90.0	75.5	21.0
11.....	30	27	90.0	48.5	17.4
12.....	30	28	93.3	41.8	17.1

Knox (6, p. 15, Table 6) gives the following numbers of 8 year old children to whom the test was applied:

NATIONALITY	Number tested	Number failed	Number correct	Number partly correct or with difficulty
Italian.....	65	12	45	8
Hebrew.....	54	7	33	14
Polish.....	46	9	21	16
Russian.....	38	15	12	11
Total*.....	203	43 or 21%	111 or 55%	49 or 24%

*The totals and per cents. are the Bureau's computation.

The per cents. for both groups of the Bureau and those of Knox show that only about half of the 8 year old children succeed, while the records of the public school children indicate that as great proficiency is attained at 9 years as at higher years. It is therefore believed that construction test A properly belongs in the 9 year level.

As the important point of observation in construction test A is the method of work, no time limit was set but inasmuch as the unsuccessful subjects usually gave up and the successful ones succeeded before the end of five minutes, the time limit of five minutes used by Healy and Knox is a fair one.

In Table 9 the average time in seconds is given for those successful.

9. NUMBER SUCCESSFUL AND THEIR AVERAGE TIME AT EACH MENTAL AGE*

GROUP	VI		VII		VIII		IX		X		XI		XII		XII+		XV	
	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time	Num- ber suc- cessful	Aver- age time
Newark.....	3	Seconds 53.66	6	Seconds 121.66	21	Seconds 70.57	37	Seconds 63.62	20	Seconds 67.85	10	Seconds 25.30	3	Seconds 22.30	.....	Seconds .....	.....	Seconds
Rome.....	3	66.60	12	106.75	21	78.00	33	91.94	9	75.88	7	97.28	4	104.50	.....	.....	.....	.....
Hudson.....	.....	.....	.....	.....	2	69.00	8	48.87	11	68.36	20	40.40	8	32.75	.....	.....	.....	.....
St. Vincent's.....	.....	.....	3	15.00	8	53.50	16	41.20	10	65.30	12	68.90	3	74.60	12	27.08	4	19.75
Total.....	6	60.16	21	97.94	52	70.59	94	70.85	50	68.90	49	49.98	18	53.94	25	27.80	5	18.00

* In the beginning of the work at Newark, the time was not uniformly recorded, hence nine cases, distributed as follows: VIII, 2; IX, 3; X, 1; XI, 3, who are recorded as successful in Table 7, are omitted in Table 9.

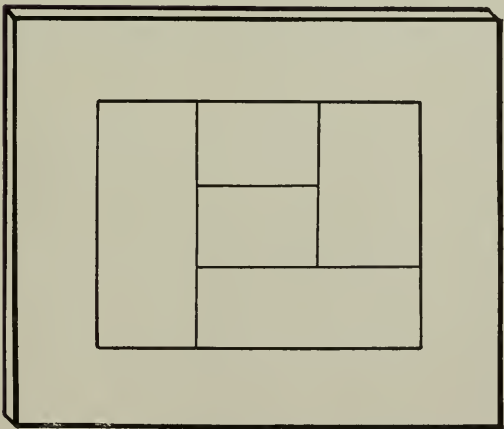
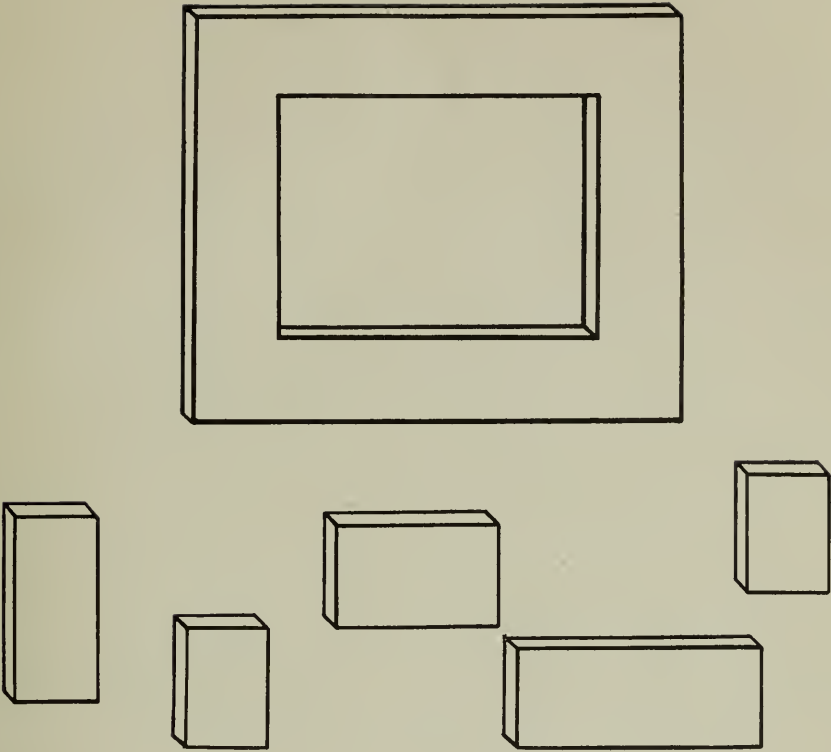


FIG. 2. CONSTRUCTION TEST A

characteristics are not sharply defined in their reactions, four distinct types are dealt with:

1. Quick, alert individuals who foresee situations and who possess such good coördination that there is no fumbling.

2. Deliberate, slow-motioned ones who make a general survey of the problem and who are accurate in selection and placing.

3. Quick-motioned, nervous, inattentive ones who pick up blocks at random and place them without forththought.

4. Clumsy, inaccurate, heavy ones who are lacking in forethought and ability to learn by experience. They attempt repeatedly to force blocks into obviously impossible spaces, substituting muscle for mind.

Method of Scoring.— Success or failure, the time and the number of moves are recorded and note is made of the method of work. Healy (5) recommends scoring under the four headings:

1. Time.

2. Number of moves.

3. Number of moves of obvious impossibilities.

4. Repetition of such obvious impossibilities.

Tabulation.— This test was used at Newark, Rome, Hudson, St. Vincent's and the public school. As it was not used at Troy or Albany the number of normal children is smaller than with the other tests. Healy (3, p. 107) says that no normal person over 8 or 9 years of age should fail to do this in 5 minutes. Knox (6) places the test in the level for 8 year old children. Table 7 gives the results of the work of the Bureau at the different institutions while Table 8 gives the results of the test with the public school children.

7. NUMBER TESTED, NUMBER AND PER CENT. SUCCESSFUL AT EACH MENTAL AGE

GROUP	VI			VII			VIII			IX		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Newark.....	10	3	30.0	16	6	37.50	39	23	58.97	44	40	90.90
Rome.....	9	3	33.3	32	12	37.50	39	21	53.84	44	33	75.00
Hudson.....	.....	.....	.....	.....	.....	.....	2	2	100.00	9	8	88.88
St. Vincent's.....	.....	.....	.....	19	3	15.78	24	8	33.33	38	16	42.10
Total.....	19	6	31.57	67	21	31.34	104	54	51.92	135	97	71.85

GROUP	X			XI			XII			XII+			XV		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Newark.....	26	21	80.70	14	13	92.80	3	3	100.00	.....	.....	.....	.....	.....	.....
Rome.....	11	9	81.81	8	7	87.50	5	4	80.00	.....	.....	.....	.....	.....	.....
Hudson.....	15	11	73.33	24	20	83.33	9	8	88.88	12	12	100.00	4	4	100
St. Vincent's.....	18	10	55.55	17	12	70.58	4	3	75.00	15	13	86.60	1	1	100
Total.....	70	51	72.85	63	52	82.53	21	18	85.71	27	25	92.59	5	5	100

The time ranges from 7" to 5' 20" with the averages as given in Table 9. It is believed that the 7" records are usually due to a fortunate beginning and that time taken in studying the problem should be considered in favor of the individual. Table 8, which shows the average time of the public school children, is the most reliable guide.

10. AVERAGE TIME, AVERAGE DEVIATION AND STANDARD DEVIATION OF PUBLIC SCHOOL CHILDREN

AGE	Average time	Average deviation	Standard deviation
	<i>Seconds</i>	<i>Seconds</i>	<i>Seconds</i>
7.....	126.8	63.04	76.23
8.....	133.5	78.37	90.16
9.....	95.9	69.69	79.12
10.....	75.5	57.76	68.28
11.....	48.5	34.32	45.87
12.....	41.8	27.31	41.03

The average and standard deviations of the successful school children in Table 10, show that the younger children who are slower also present a greater deviation in the amount of time, while the figures for 7 and 8 year old children indicate that more of the latter than of the former, possess the persistence to work at a problem until its completion, which is also shown by the average number of moves, included in Table 8.

The average number of moves of the institutional cases is given in Table 11 which demonstrates a tendency to decrease with advancing mental ability.

Value of the Test.—This test was planned to bring out the individual's method of work with a new problem and his ability to profit by the experience of repeated trials. If it is suspected that success is due to a fortunate beginning, the blocks may be turned out quickly and a second trial given.

Among the good points of the test are: the interest it awakens in many of the subjects, the simplicity of the apparatus, its portability, its independence of the language factor and of formal training. In addition to showing the method of work of a subject, it has been used with some success as a learning test and portrays such individual characteristics as perseverance, recognition of impossibilities and systematic procedure.

11. NUMBER SUCCESSFUL AND THEIR AVERAGE NUMBER OF MOVES AT EACH MENTAL AGE*

GROUP	VI		VII		VIII		IX		X		XI		XII		XII+		XV	
	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves	Num- ber suc- cessful	Average number of moves
Newark.....	2	6.50	3	30.00	19	17.30	34	19.70	15	15.80	8	8.50	1	14.00	.....	.....	.....	.....
Rome.....	3	15.66	12	26.25	21	21.33	32	20.84	9	20.88	7	23.28	4	24.75	.....	.....	.....	.....
Hudson.....	.....	.....	.....	.....	2	12.00	8	11.87	11	13.90	20	12.00	8	10.12	.....	.....	.....	8.25
St. Vincent's.....	.....	.....	3	7.33	8	10.25	15	9.33	9	10.22	11	11.54	2	11.54	12	9.91	4	.....
Total.....	5	12	18	23.72	50	17.66	89	17.66	44	15.22	46	13.00	15	14.46	25	8.88	1	5.00
																	5	7.60

* For 31 cases: Newark 27, and St. Vincent's 4, the number of moves was not recorded, hence omitted from Table 11.

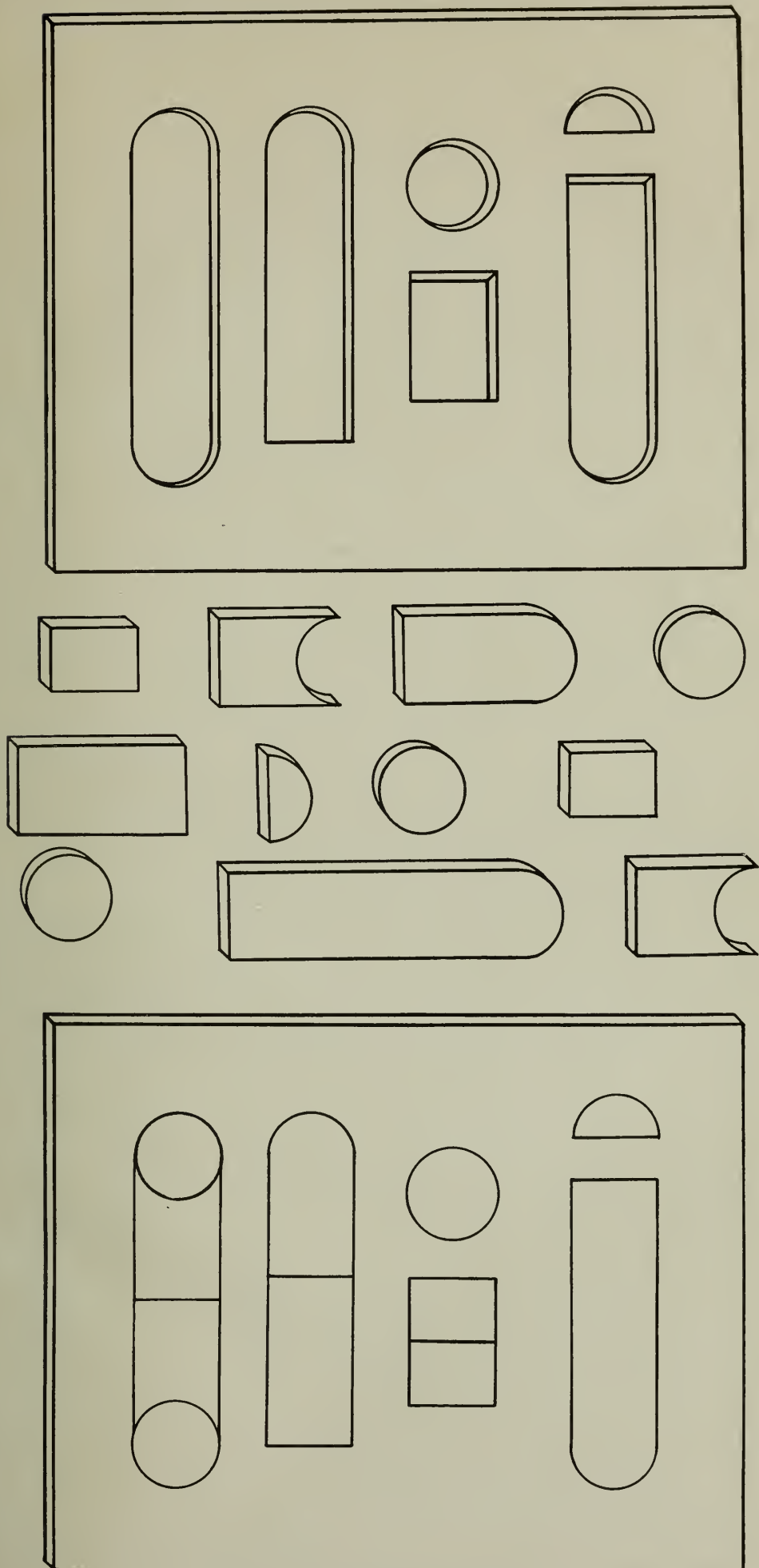


FIG. 3. CONSTRUCTION TEST B

3. CONSTRUCTION TEST B

Description of Test and Material.—Construction test B is one designed by Dr. Grace Fernald and used by Healy (5) and also by Knox (6) who refers to it as the “Fernald board.” The apparatus is a wooden frame with spaces into which fit eleven pieces of different sizes, which are interchangeable. Success does not depend upon previous moves to the extent that it does in construction test A.

Method of Presentation.—The test is given to the subject as a game. He is told that the pieces, which are scattered on the table, will all go in and exactly fill up the spaces, and that the time is being kept but there is no need of hurrying. It has been found that if the subject tries to hurry and the pieces do not fit at the first attempt he is apt to become nervous and not finish as quickly or as well as if he feels that he has plenty of time. A failure is recorded if more than five minutes are consumed in aimless moves.

Typical Reactions.—This test is one of the more difficult ones and a number of trial moves may be expected; when these do not occur it is the result either of good planning or of a lucky start. Time spent in the consideration of the problem and in the trial of reasonable combinations is not indicative of lack of natural ability. Various significant reactions occur; the most logical method of procedure is the elimination of the smaller spaces first. The aimless working of the defective mind is shown by the subject who takes out a circle after it has been correctly placed and replaces it by another, or removes a piece, then replaces it in the same position, only the other side up. The one who gathers up several pieces in his hand and tries the remaining without regard to space shows lack of reasoning. A common error is to finish with one circle left out and two half-circular spaces unfilled. The largest space presents the greatest difficulty and with that correctly filled success is usually assured.

Method of Scoring.—The results that may be reduced to absolute terms are the time and the number of moves; the fewest possible number of moves is 11. Healy recommends scoring under the same headings as given for construction test A. In addition notes are made upon the method of procedure and upon anything significant that may occur.

12. TABLE SHOWING THE NUMBER EXAMINED WITH CONSTRUCTION TEST B, THE NUMBER SUCCESSFUL AND THE PER CENT. SUCCESSFUL, AT THE DIFFERENT MENTAL AGES

GROUP	VI			VII			VIII			IX		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Newark.....	9	2	22.20	16	3	18.7	40	11	27.5	42	19	45.2
Rome.....	9	.....	.....	32	4	12.5	38	14	36.8	43	19	44.2
Troy.....	7	.....	.....	23	10	43.4	23	12	52.1	46	30	65.2
Albany.....	.....	.....	.....	18	4	22.0	23	10	43.4	26	13	50.0
Hudson.....	.....	.....	.....	2	1	50.0	10	4	40.0	31	16	51.6
St. Vincent's.....	.....	.....	.....	21	.....	.....	25	3	12.0	45	11	24.4
Total.....	25	2	8.00	112	22	19.6	159	54	33.9	233	108	46.3

GROUP	X			XI			XII			XII+			XV		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Newark.....	23	14	60.9	12	3	100.0	2	.....	.....	.....	.....	.....	.....	.....	.....
Rome.....	11	5	45.4	5	5	62.5	4	.....	.....	.....	.....	.....	.....	.....	.....
Troy.....	40	31	77.5	27	16	93.1	15	.....	.....	.....	.....	.....	.....	.....	.....
Albany.....	23	19	82.6	13	13	76.4	12	.....	.....	.....	.....	.....	.....	.....	.....
Hudson.....	52	30	57.7	62	44	70.9	25	30	83.3	12	11	91.6	9	9	100
St. Vincent's.....	25	17	68.0	18	8	72.0	5	8	62.5	21	16	76.1	1	1	100
Total.....	174	116	66.6	119	75	77.7	63	75	84.0	36	30	83.3	10	10	100

Tabulation.— Table 12 shows the number tested, the number successful and the per cent. successful, classified according to mental ages and to institutional groups. The table shows a steady rise in the per cent. successful from approximately 20% for the mental age of VII to 84% for the mental age of XII. The small groups and the uncertain classification render the results for the mental ages of XII+ and XV of less value. This table indicates that construction test B may be regarded as a measure of XI year mentality as 77% of those of XI year mentality succeeded and this is borne out by the fact that of 18 11 year old children whose mentality is also that of XI years, 15 or 83% were successful, and of 30 public school children aged 11, 26 or 86% were successful.

In Table 13 is shown the per cent. of success of the normal public school children from the ages of 7 through 12, which is higher than that for the large group of any corresponding mental age.

13. TABLE SHOWING NUMBER OF NORMAL PUBLIC SCHOOL CHILDREN TESTED, THE NUMBER SUCCESSFUL, PER CENT. SUCCESSFUL, AVERAGE TIME AND AVERAGE NUMBER OF MOVES

AGE	Number tested	Number successful	Per cent. successful	Average time	Average number of moves
7.....	30	11	36.6	<i>Seconds</i> 199.30	29.45
8.....	30	15	50.0	137.00	21.70
9.....	30	24	80.0	119.70	23.70
10.....	30	21	70.0	106.30	24.80
11.....	30	26	86.6	104.96	22.20
12.....	30	26	86.6	80.50	20.00

Table 14 gives the comparison of the institutional groups classified according to mental ages, with the school children classified according to physical ages. The advantage seems to be with the school children, but it is quite possible that if their mental age were known it would be found to be one year or more in advance of their physical age, in which case the per cent. of school children successful would correspond quite closely with the per cent. successful in the institutional group.

14. COMPARISON OF PER CENT. SUCCESSFUL OF INSTITUTIONAL GROUP AND SCHOOL CHILDREN

INSTITUTIONAL GROUP		SCHOOL CHILDREN	
Mental age	Per cent. successful	Physical age	Per cent. successful
VI.....	8.08	.....	.....
VII.....	19.60	7.....	36.6
VIII.....	33.90	8.....	50.0
IX.....	46.30	9.....	80.0
X.....	66.60	10.....	70.0
XI.....	77.70	11.....	86.6
XII.....	84.00	12.....	86.6
XII+.....	83.30	.....	.....
XV.....	100.00	.....	.....

Passing from the per cent. successful to the average time of those completing the test it is found that there is no regular relation between the amount of time and an increasing mental age, which is accounted for on the ground that more perseverance accompanies higher mental ability, so that the older children keep at the problem longer and score a higher proportion of successes. The lack of correlation between mental age and time is shown by the study of all the institutional children of the actual age of 11 who succeeded with the test, 39 in number. The best and the worst time records are made each by an 11 year old child with a IX year mentality. Table 15 shows the average time for the different mental ages classified according to institutions and the totals for the whole group. Whenever the number of subjects disagrees with the number successful in Table 12, it is due to the fact that in a few cases the time or the number of moves was not recorded.

15. TABLE SHOWING THE NUMBER SUCCESSFUL AND THE AVERAGE TIME AT EACH MENTAL AGE

GROUP	VII		VIII		IX		X		XI		XII		XII +		XV	
	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time	Num- ber suc- cessful	Average time
Newark.....	3	<i>Seconds</i> 173.6	10	<i>Seconds</i> 149.7	19	<i>Seconds</i> 143.7	12	<i>Seconds</i> 116.5	11	<i>Seconds</i> 89	2	<i>Seconds</i> 137.5	.....	<i>Seconds</i> .....	.....	<i>Seconds</i>
Rome.....	4	141.2	15	138.8	19	126.6	3	125.3	5	144.4	3	197.3	.....	.....	.....	.....
Troy.....	10	139.5	12	151	30	124.5	31	144.1	27	105.2	6	167.3	.....	.....	.....	.....
Albany.....	4	170	10	130.3	13	116.8	19	116.1	13	97.9	12	112	9	136.9	.....	.....
Hudson.....	1	193	4	120.7	16	132.3	30	117	43	98.2	20	87.9	3	118.3	.....	.....
St. Vincent's....	.....	.....	3	76.6	11	52.1	17	77.4	18	95.6	5	49.6	11	84.7	12	62
Total.....	22	152.4	54	137.1	108	121.1	112	118.4	117	100.5	48	108.7	39	113.2	13	64.2

The average deviations worked out for the whole group on the basis of the averages in Table 15 are given in Table 16.

16. TABLE SHOWING THE NUMBER OF SUBJECTS, AVERAGE TIME AND AVERAGE DEVIATION FOR EACH MENTAL AGE

MENTAL AGE	Number of subjects	Average time	Average deviations
VII.....	22	152.4	54.03
VIII.....	54	137.1	52.32
IX.....	108	121.1	49.86
X.....	112	118.4	67.33
XI.....	117	100.5	52.19
XII.....	48	108.7	65.63
XII+.....	39	113.2	64.20
XV.....	13	64.2	30.24

The average number of moves for each mental age is given in Table 17, while the average deviations for the whole group based upon the averages in Table 17, are given in Table 18.

17. TABLE SHOWING NUMBER SUCCESSFUL AND AVERAGE NUMBER OF MOVES AT EACH MENTAL AGE

GROUP	VII		VIII		IX		X		XI		XII		XII +		XV	
	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves	Num- ber suc- cessful	Average moves
Newark.....	1	19	5	18.8	11	18.4	8	18.6	7	15.5	.....	.....	.....	.....	.....	.....
Rome.....	4	24.7	15	20.8	18	20.2	3	23.3	5	18.6	.....	.....	.....	.....	.....	.....
Troy.....	10	18	12	17	30	18.3	31	21.6	27	16.9	.....	.....	.....	.....	.....	.....
Albany.....	4	13.2	10	13.1	13	14.4	19	13.6	13	12.7	12	16	9	18.3	.....	.....
Hudson.....	1	20	4	43.7	16	18.5	26	16	42	17.2	19	14.7	3	18.6	.....	.....
St. Vincent's....	.....	.....	2	11.5	11	13.6	14	13.9	17	16.5	5	14	10	15.5	12	14.2
Total.....	20	18.5	48	19.5	99	17.6	101	17.1	111	16.5	45	17.7	34	16	13	14.3

18. TABLE SHOWING NUMBER OF SUBJECTS, AVERAGE NUMBER OF MOVES AND AVERAGE DEVIATIONS FOR EACH MENTAL AGE

MENTAL AGE	Number of subjects	Average number of moves	Average deviations
VII.....	20	18.5	5.4
VIII.....	48	19.5	7.8
IX.....	99	17.6	4.9
X.....	101	17.1	5.3
XI.....	111	16.5	4.8
XII.....	45	17.7	5.8
XII+.....	34	16	4
XV.....	13	14.3	1.4

The number of moves varies little for the different mental levels.

19. COMPARISON OF AVERAGE TIME AND AVERAGE NUMBER OF MOVES OF INSTITUTIONAL GROUP WITH THAT OF PUBLIC SCHOOL CHILDREN

INSTITUTIONAL GROUP			PUBLIC SCHOOL CHILDREN		
MENTAL AGE	Average time	Average number of moves	PHYSICAL AGE	Average time	Average number of moves
	<i>Seconds</i>			<i>Seconds</i>	
VII.....	152.4	18.5	7.....	199.3	29
VIII.....	137.1	19.5	8.....	137	21.7
IX.....	121.1	17.6	9.....	119.7	23.7
X.....	118.4	17.1	10.....	106.3	24.8
XI.....	100.5	16.5	11.....	104.96	22.2
XII.....	108.7	17.7	12.....	80.5	20
XII+.....	113.2	16			
XV.....	64.2	14.3			

Although the public school children took about as much time with the test as the institutional cases and averaged more moves, a higher per cent. of them were successful. This indicates that they had the perseverance to keep at it until they accomplished it, even if not immediately successful.

At the mental age of VII a child stands 1 chance in 4 of succeeding with construction test B; at VIII, 1 chance in 3; at IX, 1 chance in 2; at X, 2 chances in 3; at XI, 3 chances in 4;

at XII, XII + and XV, 4 chances in 5. The number of moves varies little with the different mental ages.

A study of the tables shows that—

1. The test belongs at the XI year level, as stated above.
2. There is no guide to the number of moves that may be expected.
3. Both time and number of moves are of less importance than the method of work and the clinical picture that may be obtained.

Healy (3, p. 107) says: "It should be done in 10' by all normal persons from 12 years on. Most of our normal 12 year old offenders do it in from 1' to 3', but even when older persons exceed such time limits it can hardly be maintained as evidence of low ability. Again in this it is the method that it is most valuable to note—particularly the attitude of planning, as put over against taking the chances on trial and error, and particularly as against the repetition of impossibilities. This, namely, the ability to profit by experience, is registered with certainty in the number of moves made. Errors to the extent of 10 or 15 indicate little, but beyond that there is carelessness or actual inability to think out a situation. There are 11 pieces to be put in—thus normally the task should be done in at least 26 moves. Occasionally the slapdash method done by a bright person involves more moves, but only seldom. It should be remembered that a planful method may be very slow."

Value of the Test.—The purpose of the test is to show the individual's perception of form, and his method of procedure with a piece of work which requires some planning and foresight, and its use indicates that it does illuminate these traits. Determination, ability to learn by errors, power of concentration, reluctance to admit failure are shown. It is fair to add that there are persons who have no aptitude for anything which partakes of the nature of a game or puzzle, and for these the test may present undue difficulties. Still, it is not more difficult than the new situations that the normal person is often called upon to meet, for instance the packing of a suitcase. What has been said in regard to the good points of construction test A is also true of this one, while the greater difficulty of test B makes it valuable for older persons.

4. THE DRINKING CUP

Description of Test and Material.—So far as is known the device of folding a drinking cup from directions as a mental test is described here for the first time. The apparatus consists of two squares of unruled paper, one each for the examiner and the subject; typewriter paper cut into $8\frac{1}{2}$ inch squares is convenient. The problem for the subject is to make a drinking cup after the examiner has demonstrated and explained each step.

Method of Presentation.—The directions are given in the following form: "I will show you how to make a drinking cup, and when I have finished you may make one. First I fold this square piece of paper three-cornered ways through the center (move 1). Then I take this corner (the right hand acute angle) and fold it over to the opposite side (move 2) so that these two edges are equal (pointing to the arms of the isosceles triangle left in the vertex). Next I take the other corner (left acute angle) and fold it over in the same way so that the edges come straight across (move 3). Then I fold this flap down (folding down the upper flap) and put it into this outer space to hold it (move 4). Then I fold down the other flap (move 5). You see how it looks. Now take this square and make one like it." The finished cup is left in full view, but the subject is not allowed to handle it.

Typical Reactions.—In most cases if the subject succeeds with the second move he can finish without difficulty, as from that point the steps logically follow each other. It is not unusual for one, after making the first move correctly, in the second to fold the corner straight back along the line of the first fold instead of to the opposite side, which leads to an incorrect third move. He may be able to detect his mistake by looking at the sample on the table, otherwise he makes various trial moves or gives up. Under-estimation of the difficulty of the test, with a resulting lack of attention accounts for some of the failures. The work is done with varying degrees of neatness.

Method of Scoring.—The scoring is on the basis of success, which is recorded if the finished product holds together. The

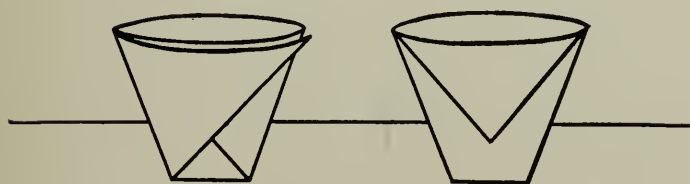
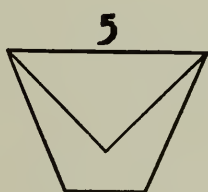
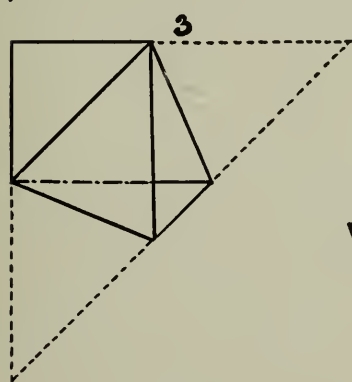
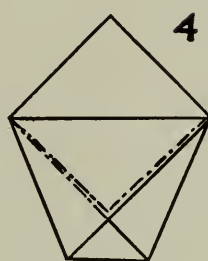
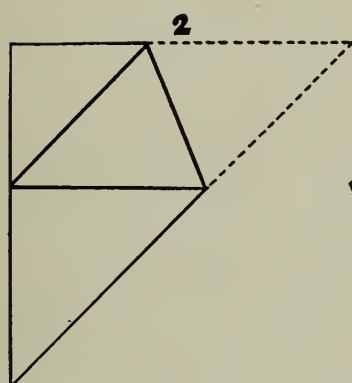
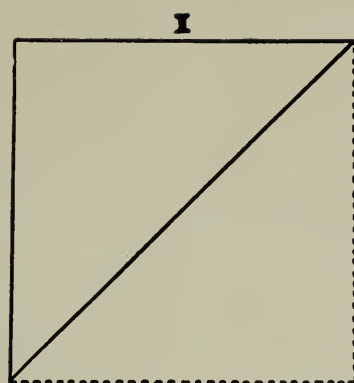
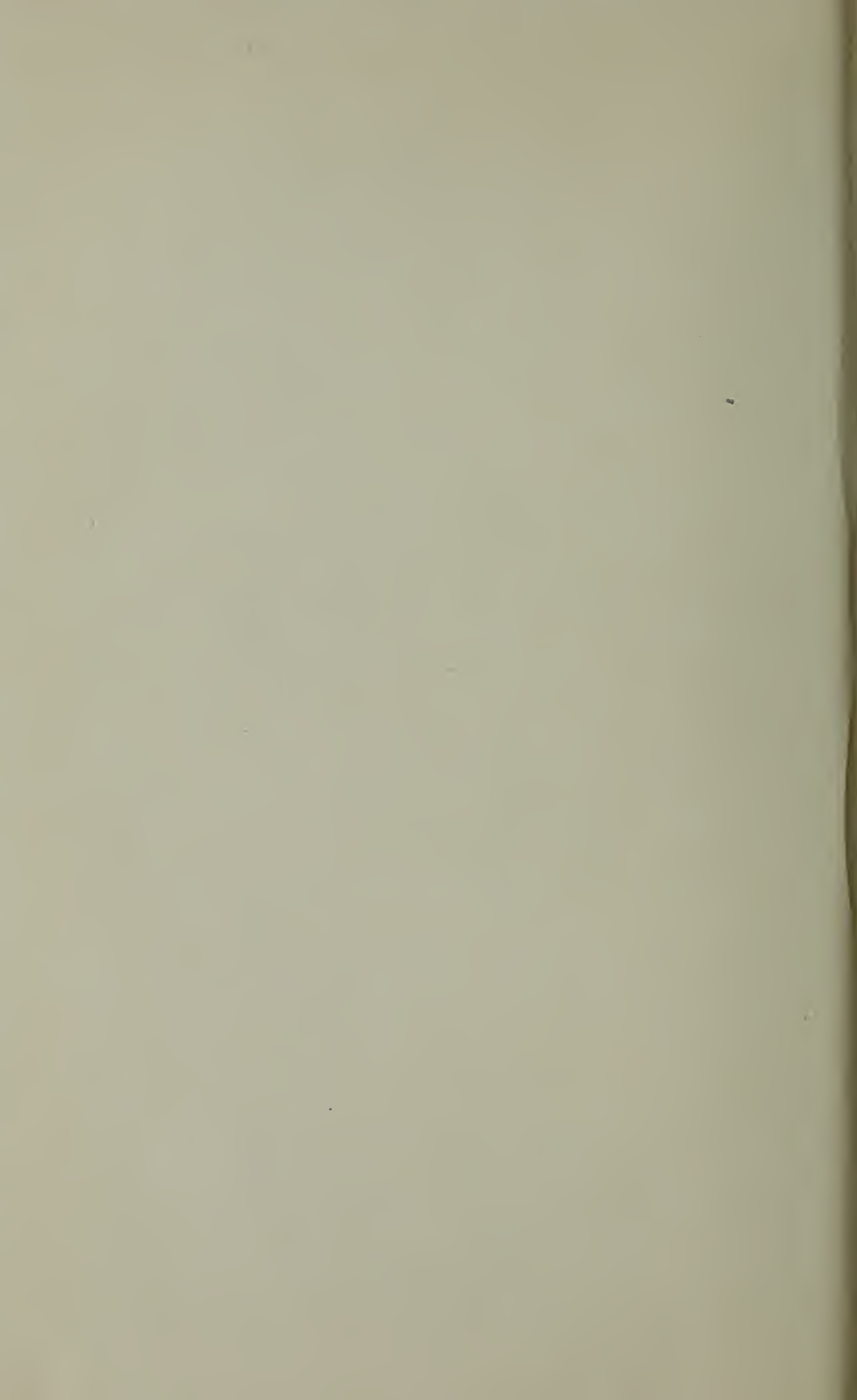


FIG. 4. DRINKING CUP



time and number of moves are recorded; the accurate following of directions involves 5 moves, hence every move above 5 is the record of a blunder. Note is made of the method of work which is considered in forming a judgment of the individual.

Tabulation.—There should be some point in the mental development of a child where he gains the ability to follow five simple, demonstrated directions, such as these, and at this point the test would indicate mental status. The totals in table 20 show that at the mental age of X 70 per cent. of the subjects succeeded.

Two factors affect the results from the two custodial asylums; (1) they were the institutions where the test was developed and the method of presentation had not become uniform, (2) all subjects in these two institutions, and also at Hudson with a mental age of less than XI, are feeble-minded. The children of Troy, Albany and St. Vincent's, since the majority of them are normal, form a homogeneous group and, as shown in Table 21, present more uniform results. The totals show that, while practically none succeeded in the mental age VI, 36 per cent. succeeded in VII, with a steady rise to X, where 79 per cent. were successful, and above X practically 90 per cent.

20. TABLE SHOWING THE NUMBER TESTED, NUMBER SUCCESSFUL AND PER CENT. SUCCESSFUL AT EACH MENTAL AGE

GROUP	VI			VII			VIII			IX				
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful			
Newark.....	8	.....	.....	8	2	25	31	6	19.35	37	18			
Rome.....	1	.....	.....	4	2	50	15	8	53.33	12	9			
Troy.....	5	1	20	20	12	60	23	14	60.86	45	27			
Albany.....	6	.....	.....	18	5	27.77	23	11	47.81	26	17			
Hudson.....	.....	.....	.....	2	.....	.....	10	4	40	29	18			
St. Vincent's.....	15	.....	.....	38	11	28.94	34	17	20.58	58	42			
Total.....	35	1	2.85	90	32	35.55	136	60	44.11	207	131			
GROUP	X			XI			XII			XII+			XV	
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful
Newark.....	19	7	36.84	11	8	72.72	3	3	100					
Rome.....	2	1	50	2	1	50	2	1	50					
Troy.....	38	30	78.94	23	21	91.30	4	3	75	77.77	7	77.77		
Albany.....	23	21	91.30	17	13	76.47	13	12	92.30	3	3	100		
Hudson.....	45	29	64.44	53	44	83.01	22	18	81.81	10	7	70	11	100
St. Vincent's.....	40	29	72.50	34	32	94.11	10	9	90	32	28	87.50	1	100
Total.....	167	117	70.06	140	119	85	54	46	85.18	54	45	83.33	12	109

21. TABLE SHOWING NUMBER OF ORPHAN ASYLUM CHILDREN WHO TOOK THE DRINKING CUP TEST, THE NUMBER SUCCESSFUL, AND THE PER CENT. SUCCESSFUL FOR EACH MENTAL AGE

GROUP	VI			VII			VIII			IX		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Troy.....	5	1	20	20	12	60	23	14	60.8	45	27	60
Albany.....	6	.....	.....	18	5	27.7	23	11	47.8	26	17	65.3
St. Vincent's.....	15	.....	.....	39	11	28.2	34	17	20.5	58	42	72.4
Total.....	26	1	3.8	77	28	36.3	80	42	52.5	129	86	66.6

GROUP	X			XI			XII			XII+			XV		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Troy.....	38	30	78.9	23	21	91.3	4	3	75	.....	.....	.....	.....	.....	.....
Albany.....	23	21	91.3	17	13	76.4	13	12	92.3	.....	.....	100	.....	.....	.....
St. Vincent's.....	40	29	72.5	34	32	94.1	12	11	91.6	31	27	87	.....	.....	100
Total.....	101	80	79.2	74	66	89.2	29	26	89.6	34	30	88.2	1	1	100

The above results are comparable with the performances of public school children of corresponding physical ages.

22. TABLE SHOWING THE NUMBER OF PUBLIC SCHOOL CHILDREN TESTED AT EACH PHYSICAL AGE, THE NUMBER SUCCESSFUL AND THE PER CENT. SUCCESSFUL

AGE	Number tested*	Number successful	Per cent. successful
7.....	30	9	30
8.....	29	15	51.7
9.....	28	19	67.8
10.....	29	22	75.8
11.....	27	24	88
12.....	25	21	84

* Twelve of the 180 children tested already knew how to fold the drinking cup.

23. TABLE SHOWING PER CENT. SUCCESSFUL OF ORPHAN ASYLUM CHILDREN CLASSIFIED ACCORDING TO MENTAL AGE AS COMPARED WITH PUBLIC SCHOOL CHILDREN CLASSIFIED ACCORDING TO CHRONOLOGICAL AGE

ORPHAN ASYLUM CHILDREN		PUBLIC SCHOOL CHILDREN	
Mental age	Per cent. successful	Chronological age	Per cent. successful.
VI.....	3.8		
VII.....	36.3	7.....	30
VIII.....	52.5	8.....	51.7
IX.....	66.6	9.....	67.8
X.....	79.2	10.....	75.8
XI.....	89.2	11.....	88.8
XII.....	89.6	12.....	84
XII+.....	88.2		
XV.....	100		

These results involving 619 children place the drinking cup test at the X year level. In order further to judge whether normal 10 year old children may be expected to follow successfully the five directions involved in making the drinking cup, the records of all the 10 year old children grading at age mentally were examined; of 16 such children found, 15 were successful; while of the 21 children 10 years old who were one year retarded mentally, only 11 succeeded; and of 8 children 10 years old one year advanced mentally all succeeded.

Two factors enter into the amount of time taken to fold the drinking cup, either hesitation and confusion, or care to produce a good finished product. The average time for the public school children given in Table 24 shows that the test may be done by 10 year old children in about 1 minute, but that the little hands of the younger children work more slowly.

24. TABLE SHOWING THE AVERAGE TIME REQUIRED BY NORMAL PUBLIC SCHOOL CHILDREN TO FOLD THE DRINKING CUP

AGE	Number tested	Number successful	Average time
			<i>Seconds</i>
7.....	30	9	74
8.....	29	15	82.8
9.....	28	19	64
10.....	29	22	58.9
11.....	27	24	64.5
12.....	25	21	51.7

Table 25 gives the average time for the successful subjects from Troy, Albany, Hudson and St. Vincent's (records of time and number of moves were not begun until after the work at Rome and Newark was closed).

25. TABLE SHOWING THE AVERAGE TIME REQUIRED BY INSTITUTIONAL CHILDREN TO FOLD THE DRINKING CUP

MENTAL AGE	Number of subjects*	Average time
		<i>Seconds</i>
VII.....	28	67
VIII.....	46	62.23
IX.....	104	63.42
X.....	108	62.23
XI.....	110	59.66
XII.....	42	47.28
XII+.....	44	50.84
XV.....	12	42.91

*All available records for each table are used, although in a few cases either the time or the number of moves was not recorded. These are all included in Tables 20, 21, and 23, but are necessarily omitted from Tables 25, 26, and 27, hence the difference in the totals.

While these tables serve as a guide to judge the individual performance, the reason for delay is regarded as of more importance than the actual variation in time.

Table 26 shows that of 496 subjects who succeeded and for whom there were data, 67 per cent. finished in 5 or the least possible number of moves, or in other words followed directions exactly, while 33 per cent. succeeded after one or more false moves.

26. TABLE SHOWING THE NUMBER AND PER CENT. OF SUBJECTS WHO COMPLETED THE DRINKING CUP IN 5, 6, 7, 8 OR MORE MOVES

NUMBER OF MOVES	Number of subjects	Per cent. of subjects
5.....	330	67
6.....	70	14
7.....	52	10
8.....	23	5
More than 8.....	21	4
	496	100

The results given by mental ages in Table 27 show that from the mental age of VIII through XII there is no constant change in the proportion of subjects finishing in five moves.

27. TABLE SHOWING NUMBER OF MOVES IN MAKING THE DRINKING CUP AS COMPARED WITH THE MENTAL AGES OF THE SUBJECTS

MENTAL AGE	Number of subjects	NUMBER OF MOVES				
		5	6	7	8	More than 8
VI.....	1	1	.....	.....	.....	.....
VII.....	28	20	7	1	.....	.....
VIII.....	45	38	3	3	1	.....
IX.....	103	61	17	17	5	3
X.....	110	68	12	11	7	12
XI.....	110	67	21	14	3	5
XII.....	44	35	4	2	3	.....
XII+.....	43	31	4	3	4	1
XV.....	12	9	2	1	.....	.....
	496	330	70	52	23	21

With public school children the average number of moves at age 7 was 5.2; at age 8, 5.8; at age 9, 6.1; and age 10, 5.6; at age 11, 6.6; and at age 12, 6.1. As the drinking cup is intended

primarily as a test of ability to follow five directions, the completion of the cup in more than five moves must be regarded as less satisfactory than when it is done in five moves; on the other hand ability to correct and detect errors is not to be disregarded.

Value of the Test.—The test is considered valuable because it furnishes a simple device for testing the ability to grasp and follow instructions. The instructions are given both graphically and verbally as might occur under ordinary conditions of life. Failure may result from (1) lack of attention either from poor concentration or over-confidence; (2) lack of memory to retain the five directions; (3) lack of ability to detect obvious errors; (4) lack of ability to correct moves recognized as wrong. It also indicates the habitual method of work, whether neat or careless. As this is the drinking cup of the Boy Scouts it is well to inquire if the subject already knows how. The following are some of the good points of the test: (1) it requires no apparatus other than two squares of paper and never fails to interest the subject; (2) self-consciousness does not enter largely into the result; (3) formal education does not aid in the completion of the test; (4) it requires no elaborate use of language and hence can be used with deaf-mutes and foreign-speaking people.

5. MOTOR CO-ORDINATION

Description of Test and Material.—The blank for this test is one used by Healy (5) but suggested by Whipple. As shown by Figure 5, heavy black lines divide a white sheet into 150 half-inch squares. The tapering end of a pen holder is used for tapping.

Method of Presentation.—The subject, in a comfortable position at a table, is told to tap as many squares as possible in the time allowed without missing one or hitting a line. He starts at a given signal and stops sharply at the end of 30". The test is then given a second time for comparison.

Typical Reactions.—Since it is not difficult for the normal child to strike within the limits of the squares, inability to do so indicates a lack of ordinary muscular control. Missing a square, hitting one twice or hitting a line, each counted an error, give evidence of such lack, which is also shown by those who strike harder and harder in their efforts to keep within the spaces. Healy's instruction to reverse direction at the end of each line to save time was not given with these cases; therefore when one did so of his own accord it was considered a merit.

Method of Scoring.—The number of squares and the errors, which are counted as the test is in progress, are recorded. For statistical work it is desirable to reduce the score to a single term and satisfactory results are obtained by subtracting two from the total number of squares for each error.

Tabulation.—Computed on this basis the average number of squares for each mental age is given in Table 28. The problem is to determine the reasonable expectation for each age and the point at which the maximum of efficiency is reached.

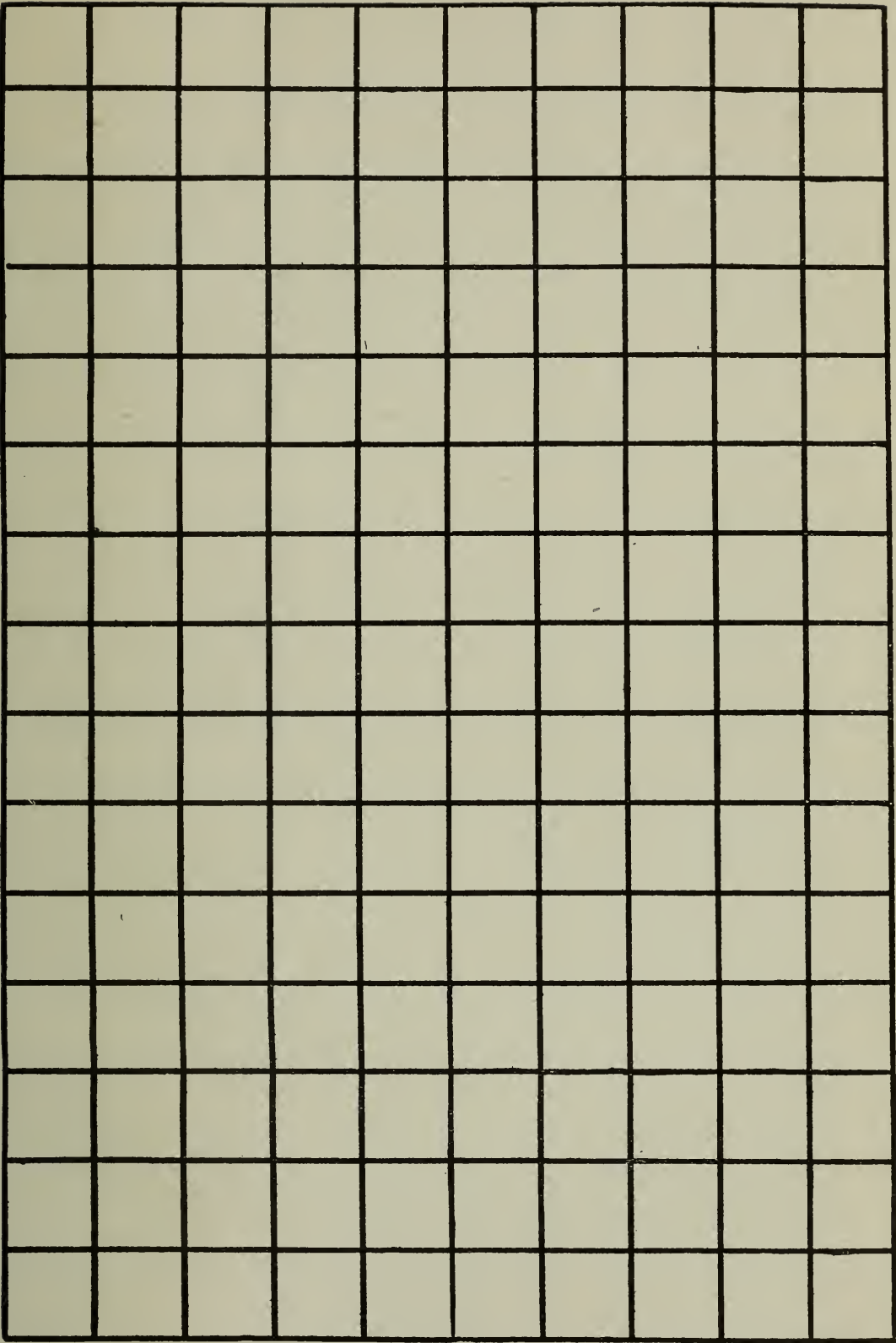


FIG. 5. MOTOR CO-ORDINATION

The superiority of the Hudson cases at each mental level suggests that a high score may depend upon some factor other than mental development. Table 29 in which the same records are reassembled under the classification of physical age shows a gradual rise from 5 to 17 years. This rise and the close similarity of the results for each group show this classification to be the consistent one. The increasing divergence between the mental and physical ages, shown in Table 30, as the years advance is because a larger proportion of the older than the younger children have fallen back into the lower mental age groups.

29. NUMBER TESTED AND THE AVERAGE NUMBER OF SQUARES AT EACH PHYSICAL AGE

GROUP	5		6		7		8		9	
	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares
Troy.....	3	41	21	40	22	44.3	23	53.1	22	56.8
Albany.....	.....	.....	6	43.7	7	42.7	14	49.4	19	58
Hudson.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Vincent's.....	.....	.....	.....	.....	.....	.....	.....	34	11	55.1
Total.....	3	41	27	40.8	29	43.9	39	50.8	52	56.9

GROUP	10		11		12		13		14	
	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares
Troy.....	23	63.9	29	64.6	23	66.8	20	64.8	11	78.4
Albany.....	24	60.8	18	68.5	14	73.2	15	80.1	4	82.5
Hudson.....	.....	.....	.....	.....	1	56	4	66	10	71
St. Vincent's.....	14	51.5	14	61.7	28	62.3	34	64.8	33	69.2
Total.....	61	59.6	61	65.1	66	66.1	73	68	58	72.2

29. NUMBER TESTED AND THE AVERAGE NUMBER OF SQUARES AT EACH PHYSICAL AGE — (Concluded)

GROUP	15		16		17		18		19		20	
	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares	Number tested	Average number of squares
Troy.....	5	76.8	2	71.5	2	62	.....	.....	.....	.....	.....	.....
Albany.....	4	75.2	1	77	.....	.....	.....	.....	.....	.....	.....	.....
Hudson.....	23	77.3	33	77.1	40	85.2	28	83	21	84.1	15	87.2
St. Vincent's.....	21	71.1	4	89.2	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	53	74.7	40	77.8	42	84	28	83	21	84.1	15	87.2

30. COMPARISON OF THE AVERAGES FOR THE MENTAL AND PHYSICAL AGES

MENTAL AGE	Average number of squares	PHYSICAL AGE	Average number of squares	PHYSICAL AGE	Average number of squares
V.....	34.2	5	41	16	77.8
VI.....	41.4	6	40.8	17	84
VII.....	45.9	7	43.9	18	83
VIII.....	53.7	8	50.8	19	84.1
IX.....	62.9	9	53.9	20	87.2
X.....	71.4	10	59.6		
XI.....	74.9	11	65.1		
XII.....	80	12	66.1		
XII+.....	76.5	13	68		
XV.....	89.9	14	72.2		
		15	74.7		

Table 31 of the distribution of errors shows that half of the subjects completed the test without errors, while 78 per cent. made less than 3 errors.

31. DISTRIBUTION OF ERRORS FOR EACH PHYSICAL AGE

NUMBER OF ERRORS	0	1	2	3	4	5	6	7	8	9	10 or more	Total
Physical age:												
5.....	1	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	3
6.....	8	5	2	1	6	1	3	.....	.....	.....	1	27
7.....	14	5	5	.....	2	.....	.....	2	1	.....	.....	29
8.....	17	7	7	4	1	2	.....	1	.....	.....	.....	39
9.....	29	7	4	4	2	1	1	1	.....	.....	3	52
10.....	28	7	10	7	3	4	1	.....	.....	.....	1	61
11.....	38	9	5	4	3	1	.....	.....	1	.....	.....	61
12.....	37	10	7	6	3	2	1	.....	.....	.....	.....	66
13.....	39	12	9	9	1	1	.....	1	.....	.....	.....	73
14.....	31	9	4	8	4	1	.....	1	.....	1	.....	58
15.....	23	5	13	5	4	2	.....	.....	1	.....	.....	53
16.....	17	8	5	5	4	.....	1	.....	.....	.....	.....	40
17.....	17	9	3	6	4	1	2	.....	.....	.....	.....	42
18.....	16	5	3	2	.....	1	1	.....	.....	.....	.....	28
19.....	10	3	1	3	3	.....	.....	.....	.....	.....	1	21
20.....	11	2	2	.....	.....	.....	.....	.....	.....	.....	.....	15
	336	103	82	64	40	17	10	6	3	1	6	668

Healy says (3, p. 110): "Above 12 years old we expect from individuals of ordinary ability at least 60 squares tapped in 30" with not more than 3 or 4 errors." The tables indicate that a fair standard would be 80 squares, with not more than two errors, for a 17 year old person.

Value of the Test.— This is more obviously a physical test than

the others in the series, and as such it is interesting to note, depends upon physical age more directly than upon mental development. A coarse estimation of muscular control may be made from the form-board, but it is too easy for children over 9 years, while this test may be used with profit for adults as well as children. The result of the simplicity of the apparatus is that few functions other than the one tested are involved. Although this is probably the least interesting of the tests, there is little indication that subjects fall short of their best through indifference.

State of New York—State Board of Charities

DEPARTMENT OF STATE AND ALIEN POOR
BUREAU OF ANALYSIS AND INVESTIGATION

CANCELLATION TEST

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1697053242784651390312695874048205G163794180569372
204857613971680254396014239580692732815H2016487953
41256809735937621848697514023835167904296243A15087
5213409687342B806571736520981439684057210732948615

51684923701275048693418025637175608924378690G43125
7805134269240976153832041579684812673905L379065214
3597846102518237496085932410793452F086179316758402
27396508149736150284048596213E09315648724235679081
4253017986386091547293674D801256493120758627490538
9473856216093827145P781096435252794163801048237956
098256174383546R9201760213795842184957038092186743
1046279538S062843975127456038915078421695681924370
86149T23057451728630919568374086207354912473501869
632170849579Z1503826563271840970683915248504312697

FIG. 6. CANCELLATION TEST

6. CANCELLATION

Description of Test and Material.— This test in various forms has been used by many psychologists as a measure of attention. The essential principle is the crossing out of one or more of the designated symbols on a printed sheet. The form used in this series (Figure 6) is a sheet of paper 11" by 8½", on which is printed a block of different numerals and letters properly spaced, arranged in twenty lines with fifty characters in a line. Each numeral appears five times in a line except when its place is taken by one of the letters, which are introduced to form oases for the eye as it travels over the line. A well-sharpened pencil and a stop watch for timing the operation are the only tools necessary. The form as printed was found to be too long for young children, hence the sheets were cut in half, the division falling as indicated by the heavy line on the blank, and the tables are based on the time for the half sheet.

Method of Presentation.— The subject after being asked to point out one is told to cross out as quickly as possible all the 7s. No suggestions as to the method are made. It is essential that there be good light and the subject should rest his forearm comfortably on the table. Great variation in the results occurs when the directions are modified. Probably the best form of instruction is: "See how quickly you can put a mark through every seven on the sheet," which induces a better time reaction than: "See how long it will take you to put a mark through every seven on the sheet."

Typical Reactions.— The reactions fall into the headings, slow and accurate, rapid and accurate, slow and inaccurate, rapid and inaccurate. The school children almost uniformly did the work systematically, a few by vertical lines, and a few checked alternate lines backward. Unsystematic work and the missing of symbols were encountered most frequently in the mentally defective. It has been observed that nervous subjects who show marked instability, are able, nevertheless, in many cases to give the intense attention for the short time necessary to finish the test,

Method of Scoring.—The time and the number of errors are recorded but the time is the important element, since by the instructions the time record is the one emphasized.

Tabulation.—When the test was used with the public school children the instructions were given as suggested by Fernald (1) with the attention focused upon accuracy rather than speed. The results are given in Table 32; in comparison with the other groups the time is decidedly slower.

32. AVERAGE TIME, AVERAGE DEVIATION AND STANDARD DEVIATION OF PUBLIC SCHOOL CHILDREN

PHYSICAL AGE	Average time	Average deviation	Standard deviation
7.....	231.2	63.30	81.23
8.....	217.6	55.25	75.19
9.....	143.4	32.60	49.83
10.....	141	27.33	32.82
11.....	117.9	23.22	28.03
12.....	96.2	18.83	23.09

In Troy also where accuracy was emphasized the children were slower than the Albany children who were instructed to do it as fast as possible.

The Hudson girls in general have a better record than any of the others, due perhaps to the fact that they are older. Woodworth and Wells (14) noted that in their cases the women averaged faster than the men.

Forty-six additional records became available after the time the final computations were begun, and these are included in Table 34 (only) from which it appears that from the age of 6 children can do the test, but not until the age of 10 or 11 is their speed sufficient to indicate the skill and close attention which the test is intended to gauge. A child of 11 should do the test in two minutes, with not more than one error, and at the age of 13 the time should be lowered to one and one-half minutes. Capable adults average about one minute for time reaction.

34. AVERAGE TIME OF 693 SUBJECTS GROUPED (1) ACCORDING TO PHYSICAL AGE, (2) ACCORDING TO MENTAL AGE

PHYSICAL AGE	Average time	MENTAL AGE	Average time
5	135	.....	.....
6	217	V.....	253
7	230	VI.....	245
8	188	VII.....	196
9	164	VIII.....	167
10.....	137	IX.....	128
11.....	120	.....	.....
12.....	107	X.....	106
13.....	99	XI.....	99
14.....	99	XII.....	89
15.....	103	XII+.....	87
16.....	106	XV.....	91
17.....	84	.....	.....
18.....	93	.....	.....
19.....	82	.....	.....
20.....	88	.....	.....

Table 34 gives the average time for 693 subjects grouped first according to their physical and then according to their mental ages. The correspondence in time at the different age levels is not between 6 and VI, 7 and VII, but between 7 and VI, 8 and VII, 9 and VIII, and 10 and IX. From this the conclusion is drawn that the factor of physical development plays a coördinate part with that of mental development. The averages for the mental age groups are brought up by the retarded children and the retardation is relatively greater at the higher ages. Thus there is a drop of two years between the corresponding averages of the later years, 12 matching X and 13, XI.

The question of errors is next in importance. Table 35 shows the distribution of errors according to the mental ages and Table 36 gives the same worked out on a basis of per cents.

35. TABLE SHOWING THE DISTRIBUTION OF ERRORS OF SUBJECTS
GROUPED ACCORDING TO MENTAL AGE

ERRORS	MENTAL AGE										Total
	V	VI	VII	VIII	IX	X	XI	XII	XII+	XV	
0.....	1	...	11	28	68	72	74	27	25	7	313
1.....	...	1	6	17	28	25	29	12	10	...	128
2.....	...	...	6	8	19	11	7	3	5	2	61
3.....	1	1	4	6	6	9	3	4	...	...	34
4.....	...	1	3	3	4	...	1	1	...	...	13
5.....	...	...	5	3	5	4	2	2	...	1	22
6.....	...	3	4	2	5	4	3	...	...	...	21
7.....	...	...	3	2	...	3	...	...	1	...	9
8.....	...	1	...	1	...	...	1	...	...	...	3
9.....	1	2	2	...	...	...	...	...	...	...	5
10.....	...	...	2	...	...	1	...	...	...	...	3
11.....	...	1	1	1	1	...	...	...	...	...	4
12.....	...	1	1	...	...	...	...	...	...	1	3
13.....	...	...	...	...	1	...	...	...	...	...	1
14.....	...	...	...	...	...	...	...	...	...	...	0
15 or more.....	1	2	3	1	1	...	...	...	...	...	8
Unknown.....	...	...	1	2	6	3	4	...	3	...	19
Total.....	4	13	52	74	144	132	124	49	44	11	647

36. PER CENT. DISTRIBUTION OF ERRORS OF SUBJECTS GROUPED
ACCORDING TO MENTAL AGE

ERRORS	MENTAL AGE										Total
	V	VI	VII	VIII	IX	X	XI	XII	XII+	XV	
0.....	25	.....	21.2	37.8	47.2	54.5	39.7	55.1	56.8	63.3	48.4
1.....	...	7.7	11.5	23	19.4	18.9	23.4	24.5	22.7	...	19.8
2.....	...	...	11.5	10.8	13.2	8.3	5.6	6.1	11.4	18.2	9.4
3.....	25	7.7	7.7	8.1	4.2	6.8	2.4	8.2	...	...	5.2
4.....	...	7.7	5.8	4	2.8	...	.9	2	...	...	2
5.....	...	...	9.6	4	3.5	3	1.7	4.1	...	9.1	3.4
6.....	...	23.1	7.7	2.7	3.5	3	2.4	...	...	...	3.2
7.....	...	...	5.8	2.7	...	2.3	...	...	2.3	...	14
8.....	...	7.7	...	1.4	...	...	.9	...	...	...	5
9.....	25	15.4	3.8	...	...	...	...	...	...	...	8
10.....	...	...	3.8	...	...	.7	...	...	...	9.1	5
11.....	...	7.7	1.9	1.4	.7	...	...	...	...	...	6
12.....	...	7.7	1.9	...	...	...	...	...	...	...	5
13.....	...	...	...	...	.7	...	...	...	...	...	2
14.....	...	...	...	...	...	...	...	...	...	...	0
15 or more.....	25	15.4	5.8	1.4	.7	...	...	...	...	...	1.2
Unknown.....	...	...	1.9	2.7	4.2	2.3	3.2	...	6.8	...	3
Total.....	...	...	...	...	...	...	...	...	...	...	100

These show that there is increasing accuracy as the intelligence increases up to eleven years where the maximum of exactness is attained. At eleven years approximately 80 per cent. may be expected to make not more than one error.

The school children for whom the accuracy was emphasized did not work any more accurately than did the other groups as shown by Table 37.

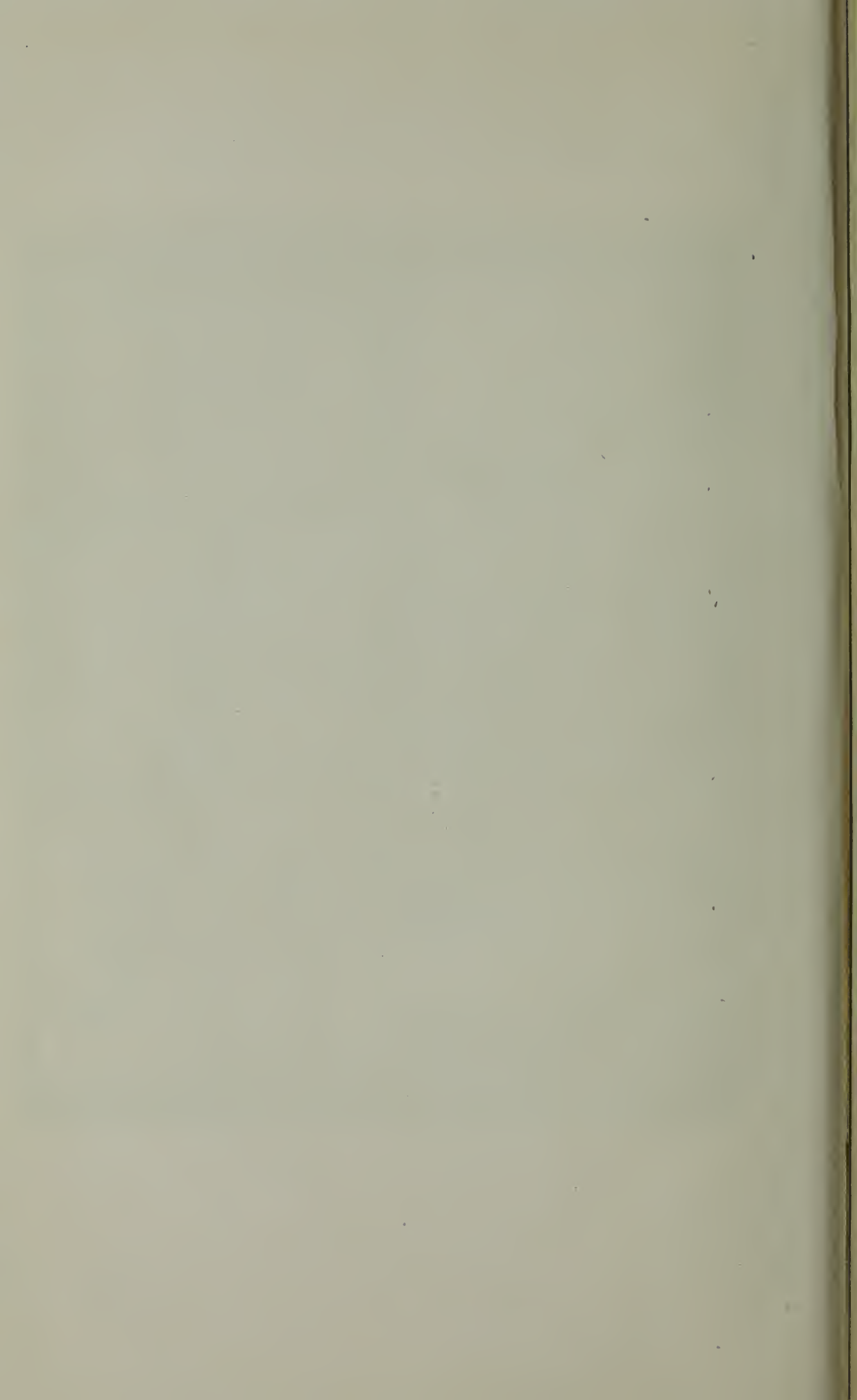
37. COMPARISON OF THE PER CENT. OF INSTITUTIONAL CASES
AND OF PUBLIC SCHOOL CHILDREN MAKING FROM 0 TO 1
ERROR

INSTITUTIONAL GROUP		SCHOOL CHILDREN	
Mental age	Per cent.	Physical age	Per cent.
V.....	25	.....	.....
VI.....	7.7	.....	.....
VII.....	32.7	7	20
VIII.....	60.8	8	56.7
IX.....	66.6	9	70
X.....	73.4	10	93.3
XI.....	83.1	11	76.7
XII.....	79.6	12	70
XII+.....	79.5	.....	.....
XV.....	63.6	.....	.....

Value of the Test.— The test measures the speed and uniformity of reaction to a definite, simple, visual stimulus. The processes involved are less complex than many of the other tests in this series and on that account give a more definite result than they. As it can be demonstrated without elaborate use of language it may be used with aliens or with deaf-mutes. Manifestly it is not a fair nor a desirable test for a subject with poor vision, but for ordinary subjects it is a useful test for attention and speed of reaction.



FIG. 7-A. RECOGNITION MEMORY



7. RECOGNITION MEMORY

Description of Test and Material.— This test is similar to one used by Fernald (1). It consists of two similar sets of ten post-cards in black and white. The sets used (Figure 7-A and 7-B) include two angora cats, looking in different directions; two dogs, one a bull dog and the other a terrier; two similar water scenes, etc. In one group the stamp space is underlined for identification.

Method of Presentation.— The subject is told to look closely at each card so that he will remember it when it is mixed with some that he has not seen. He is then shown the cards, one by one, with sufficient time to inspect each before it is covered by the next. When the ten have been shown, they are shuffled with the other set and the whole twenty presented in the same way to the subject who then designates which cards have previously been seen.

Typical Reactions.— Two kinds of errors are possible, the failure to recognize the cards that were in the first set and hence have been seen, and the selection of cards which have not been seen. By their reactions to this test subjects fall into four general groups:

1. Those who pay such close and intelligent attention that they choose only the cards which they have seen.
2. Very cautious ones, who are not sure of their impressions and reject cards which they have seen. With these a delay in their choice increases their doubts.
3. The inattentive ones unthinkingly choose the second picture because it suggests the original.
4. Low grade subjects who are entirely lacking in discrimination and choose all the cards or the ones that strike their fancy.

Taking the dogs for example, the errors fall into this order of seriousness.

1. Selecting the wrong dog, due to a lack of precise observation.
2. Selecting both dogs, due both to lack of precise observation and forgetfulness of the selection already made.
3. Selecting neither dog, due to a dense lack of observation, to forgetfulness, or to a wandering of attention.

Method of Scoring.—In view of the two separate kinds of errors the method of scoring adopted in this series was to record the number of cards chosen, and the number of those chosen that were correct, then to reduce this record to the number of errors. To do this the number of correct choices is subtracted from ten as there are ten correct choices to be made. Then the number of correct choices is subtracted from the number made which gives the number of incorrect selections. Obviously the sum of these errors gives the total errors. The same result is obtained if the incorrect cards in each pile are counted, but if the number of errors alone is recorded the significance of the results is less evident. For example, a subject might choose seven cards, all of which were correct. The record shows that he belongs to the cautious type mentioned above. Another might choose eleven cards of which nine were correct. In that case two cards were chosen which had not previously been seen and one overlooked which had been seen. The number of errors in each case is the same, but the performance differs.

Tabulation.—In Table 38 are given the average number of errors, and the average and standard deviations of the institutional subjects, grouped according to mental ages.

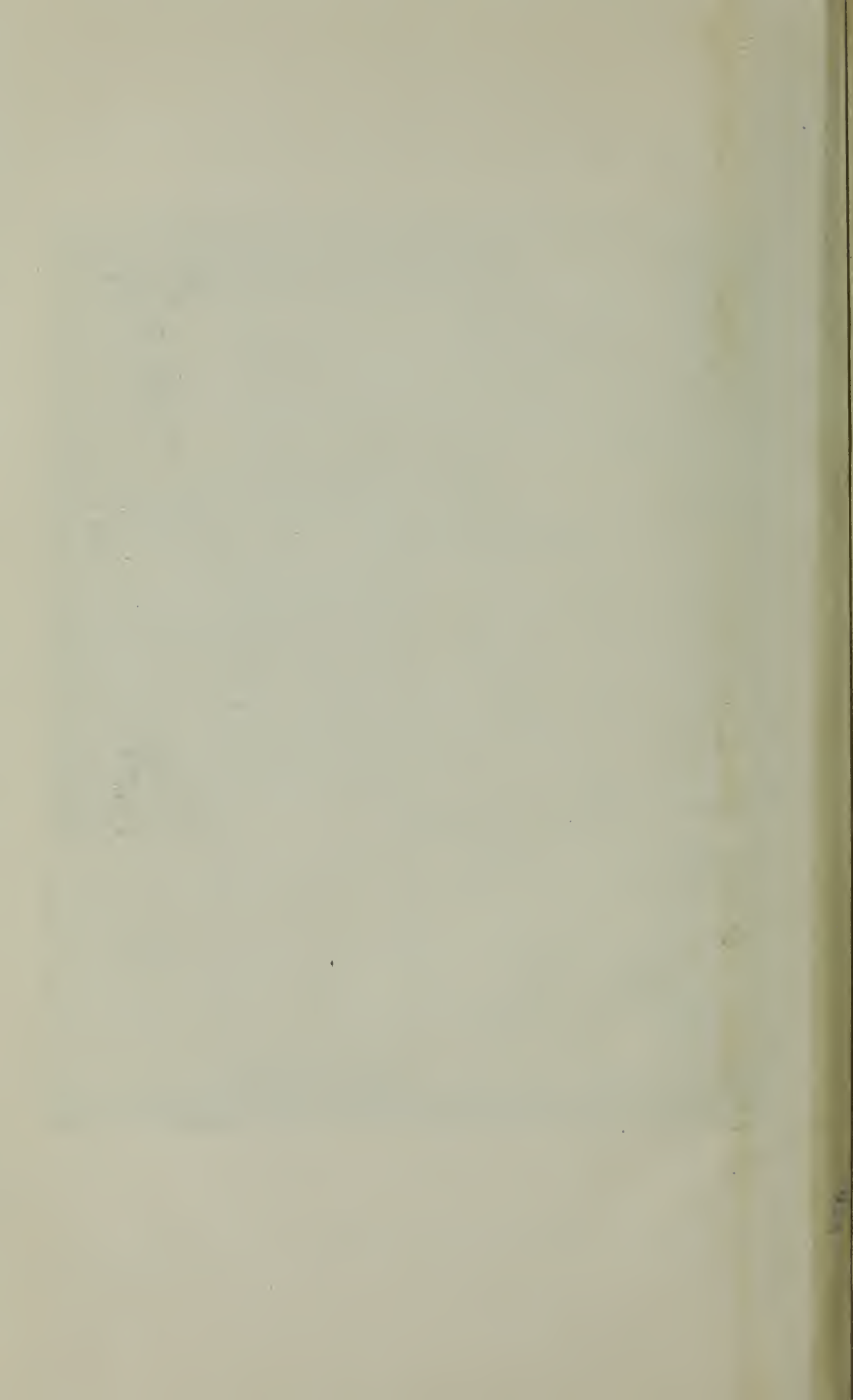
38. TABLE SHOWING THE NUMBER TESTED, AVERAGE NUMBER OF ERRORS, AVERAGE DEVIATION AND STANDARD DEVIATION AT EACH MENTAL AGE

MENTAL AGE	Number of subjects	Average number of errors	Average deviation	Standard deviation
V.....	16	7.6	1.4	2.25
VI.....	35	6.1	1.8	2.34
VII.....	89	5.5	2.6	3.17
VIII.....	151	4.9	2.1	2.43
IX.....	221	4.5	2.2	2.68
X.....	166	3.7	1.8	2.17
XI.....	147	3.3	1.8	2.31
XII.....	59	3.3	1.6	1.79
XII+.....	52	2.5	1.6	2.04
XV.....	12	3.2	2.1	2.6

The results for the school children are given with the deviations in Table 39.



FIG 7-B. RECOGNITION MEMORY



39. TABLE SHOWING THE NUMBER OF SCHOOL CHILDREN TESTED, AVERAGE NUMBER OF ERRORS, AVERAGE DEVIATION AND STANDARD DEVIATION AT EACH PHYSICAL AGE

PHYSICAL AGE	Number tested	Average number of errors	Average deviation	Standard deviation
7.....	30	3.8	2.44	2.99
8.....	30	3.06	1.6	1.98
9.....	30	2.43	1.08	1.36
10.....	30	2.83	1.62	1.97
11.....	30	2.26	1.45	1.87
12.....	30	1.9	1.4	1.83

From these tables it appears that this test in its present form is too difficult for the XII year mentality to perform without two or three errors, or on the basis of the deviations, from 0 to 4 errors.

The distribution of errors is shown in Table 40.

40. NUMBER OF SUBJECTS AT EACH MENTAL AGE WHO MADE A GIVEN NUMBER OF ERRORS

NUMBER OF ERRORS	MENTAL AGE										Total
	V	VI	VII	VIII	IX	X	XI	XII	XII +	XV	
0.....	0	0	2	3	9	13	19	2	7	0	55
1.....	0	0	6	9	16	15	15	7	10	4	82
2.....	0	1	4	19	33	21	23	18	14	3	136
3.....	1	4	16	18	32	27	26	7	8	1	140
4.....	0	4	10	29	29	38	25	12	4	1	152
5.....	1	6	10	21	30	15	10	6	4	1	104
6.....	1	6	11	15	23	19	17	2	4	1	99
7.....	4	5	5	14	17	8	4	2	0	0	59
8.....	5	3	5	11	15	5	4	2	0	0	50
9.....	1	3	3	5	6	4	1	1	0	0	24
10 or more.....	3	3	17	7	11	1	3	0	1	1	47
Total.....	16	35	89	151	221	166	147	59	52	12	948

Table 41 gives the same distribution worked out in percentages for comparison.

41. DISTRIBUTION OF ERRORS BY MENTAL AGES IN PERCENTAGES

NUMBER OF ERRORS	MENTAL AGE										Total
	V	VI	VII	VIII	IX	X	XI	XII	XII+	XV	
0.....	....	....	2.2	2	4.1	7.8	12.9	3.4	13.5	....	5.8
1.....	....	....	6.7	6	7.2	9	10.2	11.9	19.2	33.3	8.6
2.....	....	2.9	4.5	12.6	14.9	12.6	15.6	30.5	26.9	25	14.3
3.....	6.25	11.4	18	11.9	14.5	16.3	17.7	11.9	15.4	8.3	14.8
4.....	....	11.4	11.2	19.2	13.1	22.9	17	20.3	7.7	8.3	16
5.....	6.25	17.1	11.2	13.9	13.6	9	6.8	10.2	7.7	8.3	11
6.....	6.25	17.1	12.4	9.9	10.4	11.4	11.6	3.4	7.7	8.3	10.4
7.....	25	14.3	5.6	9.3	7.7	4.8	2.7	3.4	....	....	6.2
8.....	31.2	8.6	5.6	7.3	6.8	3	2.7	3.4	....	....	5.3
9.....	6.25	8.6	3.4	3.3	2.7	2.4	.7	1.7	....	....	2.5
10 or more.....	18.8	8.6	19.1	4.6	5	.6	2	....	1.9	8.3	5
Total.....	....	....	....	....	....	....	....	....	....	....	100%

Tables 42 and 43 show the distribution of errors of the school children.

42. DISTRIBUTION OF ERRORS OF PUBLIC SCHOOL CHILDREN

NUMBER OF ERRORS	PHYSICAL AGE						Total
	7	8	9	10	11	12	
0.....	....	4	2	2	7	4	19
1.....	9	4	4	7	3	10	37
2.....	5	3	13	7	8	7	43
3.....	3	5	4	4	7	6	29
4.....	2	7	5	5	1	1	21
5.....	4	3	1	....	1	1	10
6.....	2	4	1	3	2	1	13
7.....	....	....	....	2	1	....	3
8.....	3	....	....	....	....	....	3
9.....	1	....	....	....	....	....	1
10 or more.....	1	....	....	....	....	....	1
Total.....	30	30	30	30	30	30	180

43. DISTRIBUTION OF ERRORS OF PUBLIC SCHOOL CHILDREN IN PERCENTAGES

NUMBER OF ERRORS	PHYSICAL AGE						Total
	7	8	9	10	11	12	
0.....	.....	13.3	6.7	6.7	23.3	13.3	10.6
1.....	30	13.3	13.3	23.3	10	33.3	20.6
2.....	16.7	10	43.3	23.3	26.7	23.3	23.9
3.....	10	16.7	13.3	13.3	23.3	20	16.1
4.....	6.7	23.3	16.7	16.7	3.3	3.3	11.7
5.....	13.3	10	3.3	.....	3.3	3.3	5.6
6.....	6.7	13.3	3.3	10	6.7	3.3	7.2
7.....	.....	.....	.....	6.7	3.3	.....	1.7
8.....	10	.....	.....	.....	.....	.....	1.7
9.....	3.3	.....	.....	.....	.....	.....	6
10 or more.....	3.3	.....	.....	.....	.....	.....	6
Total.....	.....	.....	.....	.....	.....	.....	100%

From these tables it may be noted (1) that the school children made a better record than the group of institutional cases, but only 10 per cent. of them did it without errors; (2) that 40 per cent. of the large group made 5 or more errors; (3) that there is a steady rise in proficiency from 7 to 12 years of age for the school children and from VII to XII years mentality of the large group and that the range of deviation also decreases with increasing mental ability.

Value of the Test.—The contrast in the results between the careful, thoughtful selections of the school children and the haphazard choices of the mental defectives leads to the belief that the test is of value for diagnostic work. The cards never fail to excite interest both for the normal and defective children and even the younger children have no difficulty in grasping what is wanted. The ones who make a perfect record usually tell of some special detail by which they remembered the picture, e. g., the lamp in front of the church, the printed name of the dog, etc. Persons with a memory for detail are the most successful. However, the test as given is too hard and should be modified.

8. AUSSAGE

Description of Test and Material.—This test first proposed by Binet and advocated by Stern was given along the lines suggested by Healy and Fernald (5). The picture uniformly employed was that of the butcher's shop from the set of Binet-Simon pictures used in this country.

Method of presentation.—The examiner introduces the test in this form: "Take a good look at this picture, because when I take it away I shall ask you what you saw. I may even ask about some things that are not there." The subject is then shown the picture which is taken away promptly at the end of 15" with the question: "What did you see?" After the ideas from the free recital are exhausted the examiner begins to ask questions concerning the details of the picture and interspersed with these are questions which offer suggestions, as:

1. Did you see the electric lights?
2. Did you notice the telephone over in the corner?
3. What kind of flowers did the little girl have on her hat?
4. Was the butcher bald-headed?
5. Did you see the chicken hanging up with the other meat?
Was it dressed or were the feathers still on?
6. Did you notice the doll in the little girl's arms? What kind of a dress did it have on?
7. Did you notice the saw hanging up behind the butcher?
8. Did you see the oranges in the woman's basket?
9. Did you see the box for meat scraps under the counter?
10. Did you see the red ribbon around the dog's neck?
11. Did you see the kitten looking around the corner of the counter? Was it a gray kitten or a white one?
12. Did you see the bananas hanging up in the ice box?
Were they green or yellow?

Typical Reactions.—The type of response which may be dull or dramatic runs the entire range from limited enumeration through description to comprehensive interpretation, depending, as Binet has pointed out, largely upon the age or the mental

development of this subject. Some children reflect their school training in their full accounts told in careful English. The matter of suggestibility depends upon an innate quality. While most young children are suggestible a few are martyrs to truth in their reluctant admissions that they have not noticed the telephone and do not know what color are the flowers on the little girl's hat. Far more frequently the young child is honestly convinced that he did see a red ribbon around the dog's neck and that it is tied on one side. Still another type of response is from the subject who is trying to give the answer that will please the examiner, or thinks that details must be there or the examiner would not ask about them. Among the mentally deficient one frequently encounters the subject who monotonously answers "No" to every question or the one who eagerly accepts and enlarges upon each suggestion for example saying that he saw the chicken hanging on the wall and it was not ready to cook for the feathers were still on, and is even willing to assert that he saw an automobile outside the butcher shop. Such a subject can be led to absurd lengths in narrating the things he saw.

Method of Scoring.—Responses were checked under the following headings:

1. Type of response. Enumeration. Description. Interpretation.
2. Details. Number correct from free recital. Number correct by questioning. Number erroneous. Number imagined.
3. Suggestibility. Not suggestible. Somewhat suggestible. Very suggestible.

The scoring for suggestibility is loose. As the memory of the picture fades and the subject becomes more and more bewildered by the questions that are asked, the probability of accepting suggestions increases. Hence it depends to a certain extent upon the number of suggestions offered and the manner of the examiner. The method used has been to record the responses as not suggestible when none were accepted and very suggestible when a majority of the suggestions or impossible ones were accepted, or when suggestions were enlarged upon. As to the

nature of the response, if partly enumerative and partly descriptive it was credited as descriptive, if partly descriptive and partly interpretative, as interpretative.

Tabulation.—The type of the free recital has verified the proposition of Binet that young children confine themselves to enumeration, that older children give description and older still interpretation of pictures.

Table 44 shows the proportion of enumerative accounts decreasing and of interpretative accounts increasing as the mental age advances.

44. SHOWING IN PERCENTAGES THE TYPE OF RESPONSE TO THE PICTURE FOR THE MENTAL AGES, INSTITUTIONAL CASES

MENTAL AGE	Number of subjects	PER CENT.		
		Enumerative	Descriptive	Interpretative
VII.....	55	60	34.5	5.4
VIII.....	74	45.9	48.6	5.4
IX.....	151	37.7	43	19.2
X.....	136	30.1	43.4	26.5
XI.....	132	23.5	34.8	41.7
XII.....	49	10.2	47	42.8
XII+.....	49	8.2	30.6	61.2
XV.....	12	.....	50	50

Table 45 shows the number of each type of response for the public school children.

45. TYPE OF RESPONSE GIVEN BY SCHOOL CHILDREN

PHYSICAL AGE	Number tested	TYPE OF RESPONSE		
		Enumerative	Descriptive	Interpretative
7.....	30	19	11	0
8.....	30	16	13	1
9.....	30	6	21	3
10.....	30	7	17	6
11.....	30	1	18	11
12.....	30	5	14	11

While there is a decided difference in the value of the details that may be given, Table 46 indicates the number that may be expected from school children.

46. AVERAGE NUMBER OF DETAILS GIVEN BY PUBLIC SCHOOL CHILDREN OF EACH PHYSICAL AGE

PHYSICAL AGE	Average number of details
7.....	8.71
8.....	9.1
9.....	11.43
10.....	11.53
11.....	12.7
12.....	13.33

In view of the looseness of the scoring, the variations in the number of suggestions offered, and the personal equation which necessarily enters largely into the results, Table 47 can be regarded only as indicative of the tendency toward suggestibility.

47. SHOWING THE PER CENT. OF INSTITUTIONAL SUBJECTS WHO WERE NOT SUGGESTIBLE, SUGGESTIBLE, AND VERY SUGGESTIBLE AT EACH MENTAL AGE

MENTAL AGE	Number of subjects	PER CENT.		
		Not sug- gestible	Suggestible	Very sug- gestible
VII.....	55	3.6	41.8	54.5
VIII.....	74	16.2	33.8	50
IX.....	151	18.5	58.3	23.2
X.....	136	30.1	55.9	14
XI.....	132	47	45.4	7.6
XII.....	49	55.1	42.9	2
XII+.....	49	63.3	34.7	2
XV.....	12	66.7	33.3	.....

Table 48 gives the results for suggestibility of school children.

48. SUGGESTIBILITY OF SCHOOL CHILDREN AT EACH PHYSICAL AGE

PHYSICAL AGE	Number tested	SUGGESTIBILITY		
		Not suggestible	Suggestible	Very suggestible
7.....	30	7	20	3
8.....	30	2	21	7
9.....	30	6	15	9
10.....	30	1	23	6
11.....	30	7	20	3
12.....	30	10	18	2

The work at Newark and Rome was finished before the method of scoring became uniform, and was tabulated in the form shown in Table 49.

49. TABLE SHOWING SUCCESS AND SUGGESTIBILITY OF NEWARK AND ROME CASES

MENTAL AGE	Number tested	Average number giving satisfactory account	Not suggestible	Suggestible	Very suggestible
A. NEWARK CASES					
VII.....	9	2	22	.....	9
VIII.....	35	21	60	7	15
IX.....	39	29	74	5	15
X.....	26	24	92	12	3
XI.....	17	14	82	10	3
XII.....	3	3	100	3	.....
B. ROME CASES					
VII.....	13	5	38	.....	10
VIII.....	*30	13	43	2	16
IX.....	*35	23	65	6	10
X.....	11	8	72	1	2
XI.....	8	7	87	1	1
XII.....	5	5	100	1	1

* The degree of suggestibility is not recorded in one case, as the account given was too limited to make it probable that suggestibility could be tested fairly.

This indicates a higher proportion of very suggestible cases among the feeble-minded than among normal children of corresponding mental age.

Value of the Test.—The test is one of the most valuable and significant ones for clinical purposes. It demands “attention,

observation, retention, recall and an ability to marshal and formulate the items of experience in a verbal report." (Whipple 12.) The object is to determine the capacity of the subject faithfully to report in spoken words the results of observation. Its advantages are (1) the simple material, (2) the interest which the picture never fails to evoke. It is probable that all children are somewhat suggestible, but the retention of this trait is a characteristic of the defective mind. For this reason the test is of little value for diagnostic work with children under nine years of age, in whose cases the answers are governed by imagination rather than accurate observation, by the tendency to give the reply which the form of question calls for, and the inability to express in words impressions received. No exact-method of using the test is offered here. The estimation of the result as well as the method of questioning must be left with the examiner. In offering an insight into some phases of mental life this test fills a place untouched by any of the others. The ability to give a correct account of past events or experiences, and the independence and reliability of thought, both socially important traits, are measured to some extent.

9. PICTORIAL COMPLETION

Description of Test and Material.— This test by Healy (4) is a bright picture on a uniformly colored background which suggests ten distinct activities, each one incomplete due to a square that has been cut from it. To fill in these square spaces there is a choice of 40 small pictures and 5 blanks any one of which will fit into any one of the spaces. Since no clue is given either by the color of the background or the shape of the pieces, the completion of each situation depends entirely upon the ideas expressed in the pictures.

Method of Presentation.— The subject is led by questions to see the requirements for one situation, and is then left to his own devices to fill out the others. No suggestions as to a time element were made in this test, which is in accordance with Healy's conclusion that within reasonable limits the time is not of great importance. After the subject says he has finished he is given one more chance to make corrections. Then he is asked the reasons for his selections.

Typical Reactions.— The errors may be divided into the reasoning and unreasoning type. Healy has designated the following as rational: The unbroken window in place of the broken one; the baseball in place of the football; standing bird in place of the flying one; mouse or cat by the chicken; the cat walking away in place of the cat approaching the milk; purse in place of the hat; axe in place of the log on account of the strong association between the saw and the axe; baby under the tree in place of the basket, as the man is bringing him an apple. Whatever may be said in extenuation of these mistakes there is certainly enough logic in the correct choices to justify the expectation that thoughtful young persons will make them.

On the other hand there are unreasoning errors where the haphazard performance results in such incongruous situations as the mild, yellow, sleeping cat made to chase an obviously terrified boy, or the red fish hanging in the air under the tree.

Healy points out that as the picture was designed for children the situations are somewhat exaggerated and hence not satisfactory to the adult mind, which has the further disadvantage of

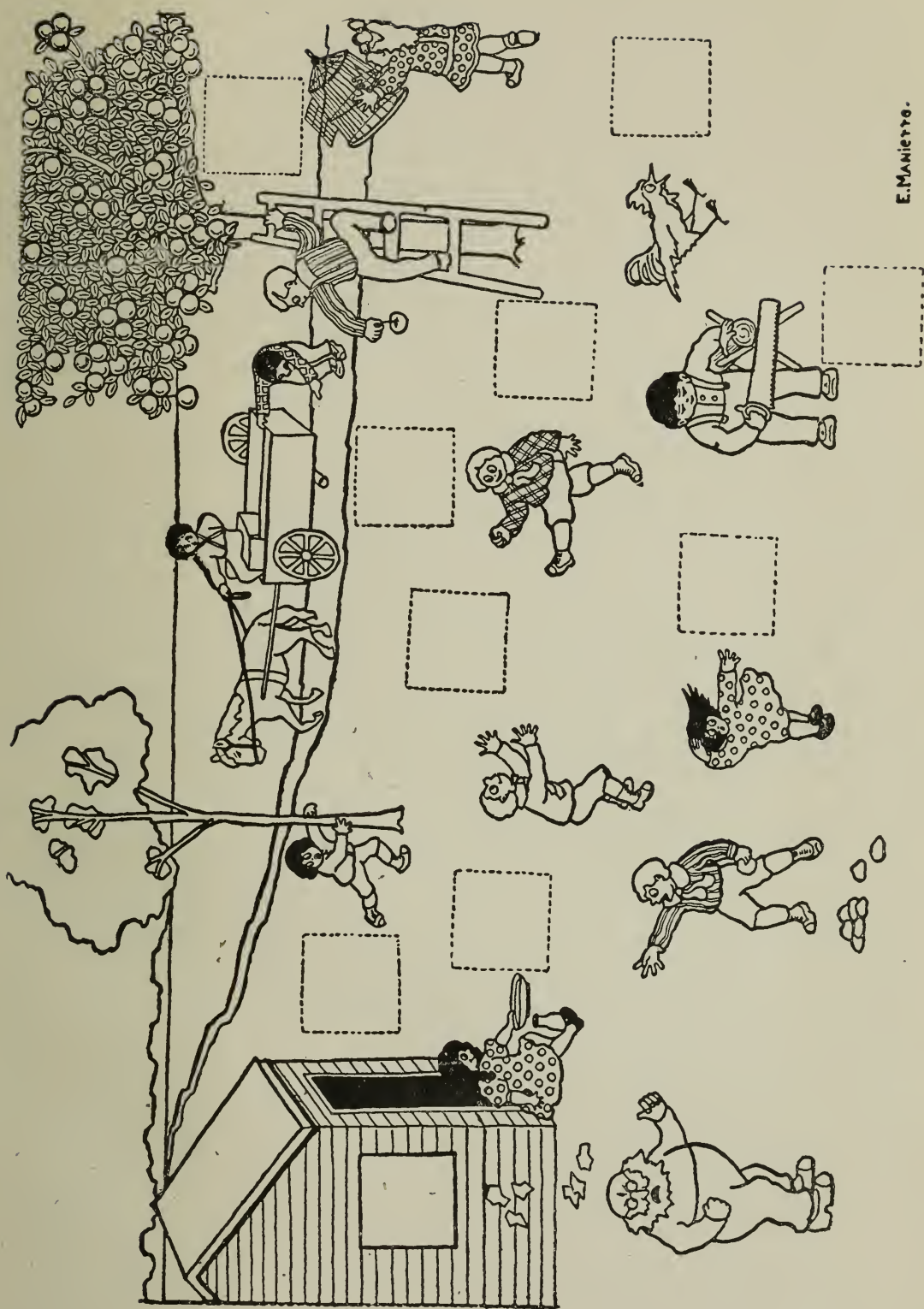


FIG. 8. PICTORIAL COMPLETION TEST

From "The Individual Delinquent"
 by William Healy, Copyright
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E. MANICER

trying to read more into the picture than its face value. The Bureau observes that children do not criticise the pictures as do adults to justify themselves for the errors which they make.

Method of Scoring.—The kind and number of errors are recorded and notes made upon the performance, the method of work and kind of reasoning employed being of great importance.

Tabulation.—The pictorial completion test was used at Newark, at Albany, for part of the work at Troy and at Hudson and with the public school children. It calls for a degree of shrewdness in the combination of possibilities in which orphan asylum children have no training, which may account for the superiority of attainment of Healy's groups. He states (3, p. 111): "At 11 years this test should be readily accomplished with not more than 1 or 2 final errors, and certainly not more than 1 illogical error. The median or average performance for all in the group of those ordinary in ability above 10 years, is 1 final error and no logical error."

Table 50 shows the distribution of errors for each of the mental ages with the median falling in the italicized groups.

50. DISTRIBUTION OF ERRORS BY MENTAL AGES

NUMBER OF ERRORS	MENTAL AGE								Total
	VII	VIII	IX	X	XI	XII	XII+	XV	
0.....	....	....	2	4	6	5	5	2	24
1.....	....	4	7	7	10	8	14	....	50
2.....	....	6	19	17	22	<i>11M</i>	<i>9M</i>	....	84
3.....	....	4	16	21	<i>20M</i>	5	13	1	80
4.....	6	7	<i>34M</i>	<i>22M</i>	19	7	5	1	101
5.....	6	13	28	22	8	1	4	1	83
6.....	6	<i>16M</i>	13	15	4	1	1	....	56
7.....	6	8	24	9	3	....	....	....	50
8.....	5	9	12	7	3	1	....	....	37
9.....	<i>6M</i>	15	4	1	1	....	....	....	27
10.....	17	13	12	1	....	....	....	....	43
Failure*.....	14	10	....	....	....	....	....	....	24
Total.....	66	105	171	126	96	39	51	5	659

* Failure scored instead of number of errors.

That this is considerably affected by the feeble-minded subjects is shown by Table 51, where the median of error for the feeble-minded is markedly lower than for normal children of corresponding mental ages.

51. COMPARISON OF RESULTS AT NEWARK WITH THOSE AT ALBANY AND TROY

NUMBER OF ERRORS	MENTAL AGE													
	VII		VIII		IX		X		XI		XII		XII+	
	A & T	N	A & T	N	A & T	N	A & T	N	A & T	N	A & T	N	A & T	N
0.....					2	....	3	1	2	1	3	...	2	...
1.....			3	....	6	....	4	....	3	1	4	...	1	...
2.....			4	....	8	....	8	....	7	2	5M	1	1	...
3.....			1	1	7	2	11M	....	4M	4M	2	...	4	...
4.....	5	....	2	2	15M	5	8	5	5	2	3	....		...
5.....	3	....	5	3	11	3	7	3	3	1	....	1	....	...
6.....	1	1	10M	2	6	2	3	6M	1	....	....	....	....	...
7.....	4M	1	2	4	3	10M	1	5	....	2	....	....	....	...
8.....	2	2	3	6	4	7	1	4	....	1	....	1	....	...
9.....	3	2	1	10M	....	2	....	....	....	....	....	....	....	...
10.....	8	9M	1	11	1	10	....	1	....	....	....	....	....	...
Total..	26	15	32	39	63	41	46	25	25	14	17	3	8	0

Table 52 gives the comparison between the children in the two orphan asylums and the public school children of corresponding physical ages, and shows no constant variation although in Table 53 the public school children failed to do as well as the orphan asylum children.

52. COMPARISON OF RESULTS AT ALBANY AND TROY WITH SCHOOL CHILDREN OF CORRESPONDING PHYSICAL AGES

NUMBER OF ERRORS	A & T	PS	A & T	PS	A & T	PS	A & T	PS	A & T	PS	A & T	PS
	VII	7	VIII	8	IX	9	X	10	XI	11	XII	12
0.....					2	3	3	2	2	2	3	....
1.....		1	3	1	6	3	4	3	3	6	4	4
2.....			4	3	8	4	8	4	7	2	5M	4
3.....			1	4	7	8M	11M	3	4M	7M	2	7M
4.....	5	3	2	4	15M	4	8	7M	5	6	3	7
5.....	3	4	5	3M	11	4	7	6	3	7	....	2
6.....	1	3	10M	4	6	1	3	1	1	....	....	2
7.....	4M	4M	2	3	3	2	1	3	....	....	....	3
8.....	2	3	3	5	4	1	1	....	....	....	....	....
9.....	3	7	1	3	....	....	....	1	....	....	....	1
10.....	8	5	1	....	1	....	....	....	....	....	....	....
Total.....	26	30	32	30	63	30	46	30	25	30	17	30

53. AVERAGE NUMBER OF ERRORS OF ALBANY AND TROY CHILDREN COMPARED WITH THOSE OF PUBLIC SCHOOL CHILDREN OF CORRESPONDING PHYSICAL AGE

MENTAL AGE	ALBANY AND TROY		PHYSICAL AGE	PUBLIC SCHOOL CHILDREN	
	Number tested	Average number of errors		Number tested	Average number of errors
VII.....	26	7.4	7.....	30	7.2
VIII.....	32	5.1	8.....	30	5.4
IX.....	63	4.1	9.....	30	3.3
X.....	46	3.3	10.....	30	3.8
XI.....	25	2.8	11.....	30	3
XII.....	17	1.9	12.....	30	3.8

Success with this test seems to depend upon qualities that are lacking in the mentally defective, as a higher average of error is shown by them than by normal children of corresponding mentality as indicated by Table 54.

54. AVERAGE NUMBER OF ERRORS OF WOMEN AT NEWARK BY MENTAL AGES

MENTAL AGE	Number tested	Average number of errors
IV.....	1	10
V.....	2	9.5
VI.....	10	8.8
VII.....	15	9.06
VIII.....	39	8.05
IX.....	41	7.24
X.....	25	5.92
XI.....	14	3.71
XII.....	3	5

It may be noted in Table 51 that two Newark cases did the puzzle without errors, and one with only one. These are high grade girls who are in the institution on account of social failure rather than low mentality. Healy found that 15 of the brightest Vineland cases ranging in age from 16 to 33 showed the median of total errors to be 5, the median of illogical errors 4, with a range in total errors from 1 to 7, and illogical from 0 to 7.

Value of the Test.— This test was originated to embody the points of the Ebbinghaus completion tests and at the same time be independent of the use of language on the part of the subject. With no guide except the meaning of the picture he must choose from forty pictures the ten that shall best fill the spaces. The ability to see the relationship between disconnected factors and the skill to follow incomplete situations to their logical conclusions belong to a high order of mentality, and the individual who demonstrates this ability by a good record with the pictorial completion test may generally speaking be considered to have a normal mentality. The reverse, however, does not hold as is shown by records of ninety-five Wellesley College girls who had a range of error from 0 to 8 with a median total of 2 errors. As a criterion of independent logical reasoning this test stands high.

10. TELLING TIME

Description of Test and Material.—A cardboard clock face, the dial $4\frac{1}{2}$ inches in diameter on a card $5\frac{1}{2}$ inches square, with Roman numerals and with movable hands is used. This is easier than a small watch face.

Method of Presentation.—The test is prefaced with the question, "Can you tell time?" The test is then made for four positions of the hands. First at an even hour, then at half past the hour, third at 20 or 25 minutes of the hour and fourth at something past; the first two combinations are arranged by the examiner, care being taken to present the dial with the XII at the top, while the subject makes the arrangement for the last two.

Typical Reactions.—The even hour and half hour combinations are naturally the easiest, especially at the hours which have some special significance to the children, nine o'clock when school begins, half past three when it is over; twelve o'clock is probably learned first. The functions of the long and short hands are frequently confused.

Method of Scoring.—Credit is given only when all four combinations are given correctly to the large divisions, i. e. 10 minutes of 10 when the hand actually points to 9 minutes of 10. Partial success is not considered as it is desired to know when the subject is actually mastered.

Tabulation.—Orphan asylum children make up a group peculiarly untaught in the matter of telling time since they depend upon the signal of a bell, rather than upon a clock, for their daily routine; and for this reason the results presented in this table would probably not be borne out by children living a normal home life. However, it appears that there is a certain point where children know how to tell time regardless of its value to them which, it is surprising to find, does not come until an XI mentality is attained. Table 55 shows a uniformity of results in the three orphan asylums, and is valuable in showing where the ability to tell time, independent of special teaching, arises.

55. ABILITY OF ORPHAN ASYLUM CHILDREN AT DIFFERENT MENTAL AGES TO TELL TIME

ORPHAN ASYLUM	VII			VIII			IX			X		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Troy.....	25	.....	.....	18	2	11.1	42	12	28.5	26	18	69.2
Albany.....	18	.....	.....	23	2	8.7	26	6	23.1	23	13	56.5
St. Vincent's.....	31	.....	.....	38	3	7.9	59	23	39	38	23	60.5
Total.....	74	.....	.....	79	7	8.9	127	41	32.3	87	54	62.1

ORPHAN ASYLUM	XI			XII			XII +			XV		
	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful	Num- ber tested	Num- ber suc- cessful	Per cent. success- ful
Troy.....	29	27	93.1	6	6	100	9	9	100	.....	.....	.....
Albany.....	17	16	94.1	13	13	100	3	3	100	.....	.....	.....
St. Vincent's.....	31	25	80.6	10	10	100	34	34	100	.....	.....	.....
Total.....	77	68	88.3	29	29	100	46	46	100	1	1	100

Table 56 gives the records for 118 Hudson cases which show that these girls who presumably have spent part of their lives outside an institution have not all learned to tell time and that it depends upon mental development rather than upon physical age.

56. NUMBER OF HUDSON TRAINING SCHOOL GIRLS TESTED, NUMBER AND PER CENT. SUCCESSFUL IN TELLING TIME AT EACH MENTAL AGE.

MENTAL AGE	Number tested	Number successful	Per cent. successful
VIII.....	7	0	0
IX.....	20	11	55
X.....	30	22	73.3
XI.....	31	22	71
XII.....	13	12	92.3
XV.....	7	7	100

Figures on this subject are given in the Report of the Commission to Investigate Provision for the Mentally Deficient (8) for 536 feeble-minded and epileptic almshouse inmates, of whom 266 or 49 per cent. were able to tell time, while 270 failed. Two hundred and seventy-five of the number were males of whom 160 or 58 per cent. were successful, and 261 were females of whom 106 or 41 per cent. succeeded. The average of success is probably raised by the epileptics who in many cases have retained their mental powers to a considerable degree.

Value of the Test.—In field work investigators require some simple questions to throw light upon suspected mental defect. Two such questions which have proved useful are: “How much is nine cents from a quarter?” and “What time is it?”

11. ANTONYMS

Description of Test and Material.—With the 1908 form of the Binet-Simon Measuring Scale for Intelligence Healy's (5) modification of the Thorndike list of antonyms was used. Later in the work the 1911 American revision of the Scale was adopted which includes the Thorndike list. This follows with Healy's words in parentheses:

good	loud	like (dead)	empty (war)
outside	white (black)	rich	war (empty)
quick	light	sick	many
tall	happy	glad	above
big	false (cheap)	thin	friend

Method of Presentation.—The test was uniformly given orally with this explanation: "When I say one word I want you to say the word that means just the opposite, so when I say *hot* what will you say?" After the subject understands the problem the list is gone through rapidly.

Typical Reactions.—For success with the antonym test two essential qualities are (1) the ability to hold the idea of giving opposites, and (2) the ability to select the word from one's vocabulary which contains the idea opposite to that of the given word. Mental defectives fail most often to hold the idea and the first lapse in giving opposites frequently sidetracks the remainder of the performance. Normal children on the other hand, even the seven year olds, seem to have little difficulty in this respect, and although they may be unable to think of the opposite of word after word, they give the correct answer as soon as they reach a word within their mental range. It frequently happens, too, that a similar may be given, followed directly by the correct opposites for the following words. Thus a normal mind can retrieve, a deficient mind usually cannot.

That children reduce the words to concrete form before they think of the opposites is indicated by the choice of the opposites. Young children invariably give *fat* as the opposite of *thin*, while a few of the twelve year olds give *stout*. *Thick* is given only in a

few cases. The children often give *small* as the opposite of *tall*, possibly associating the word with themselves. One seven year old child gave *naughty* as the opposite of *good*.

Occasionally the association of ideas is of interest as in the case of the girl in the institution who gave *trouble* as the opposite of *outside*. Another case described as No. 37 in Bulletin No. IV, (9, p. 67) "had a surprisingly varied vocabulary and in simply naming words fell into rhymes frequently as 'porch, pouch, couch, ouch', with the remark, 'That's a good one'. He could not, however, hold the idea of the opposites". This boy was sixteen years of age with a mentality of IX. Some subjects cannot retain the idea of giving opposites longer than the time it is actually being explained. Rhymes are sometimes given.

Method of Scoring.—Seventeen correct answers are necessary for success with the antonyms. The kind of failure is noted, whether the subject lapses into similars, or gives mere associations. When the subject cannot retain the idea for more than the first few words the test is recorded as a failure and no more time is spent unless continuation is likely to become illuminating from some other point of view.

Tabulation.—To determine the expectation of success Table 57 was arranged to show those successful at each physical and mental age.

57. NUMBER TESTED, NUMBER AND PER CENT. SUCCESSFUL AT EACH PHYSICAL AND MENTAL AGE

PHYSICAL AGE	Number tested	Number successful	Per cent. successful	MENTAL AGE	Number tested	Number successful	Per cent. successful
6.....	1	.....	.....	.....	.....	.....	.....
7.....	3	.....	.....	.....	.....	.....	.....
8.....	8	.....	.....	VIII.....	24	1	4.2
9.....	24	3	12.5	IX.....	153	14	9.1
10.....	34	8	23.5	X.....	162	35	21.6
11.....	40	12	30	XI.....	154	81	52.6
12.....	36	10	27.8	XII.....	45	34	75.5
13.....	63	31	49.2	XII+.....	63	42	66.6
14.....	60	25	41.7	.....	.....	.....	.....
15.....	51	16	31.4	XV.....	16	15	93.7
16.....	52	23	44.2	.....	.....	.....	.....
17.....	51	20	39.2	.....	.....	.....	.....
18.....	40	23	57.5	.....	.....	.....	.....
19.....	28	9	32.1	.....	.....	.....	.....
20 or over.....	126	42	33.3	.....	.....	.....	.....
Total.....	617	222	36	.....	617	222	36

The classification by mental development is more consistent than the one by chronological ages, due to the subjects upon whom the test was tried, as most of those over fourteen were either known or suspected to be feeble-minded.

Table 58 which gives the results with the public school children shows that with them the eleven year children came close to the twelve year olds in their success with the test.

58. NUMBER OF PUBLIC SCHOOL CHILDREN TESTED, NUMBER AND PER CENT. SUCCESSFUL

PHYSICAL AGE	Number tested	Number successful	Per cent. successful
7.....	30		
8.....	30	8	26.6
9.....	30	15	50
10.....	30	15	50
11.....	30	25	83.3
12.....	30	26	86.6

The next question under consideration is the relative difficulty of the words. Below, the words are arranged in order of difficulty upon the basis of the per cent. of failures. Owing to the substitution of three words by Healy there are twenty-three words to be considered.

59. WORDS ARRANGED ACCORDING TO DIFFICULTY WITH PER CENT. OF FAILURES

WORD	Per cent. of failures	WORD	Per cent. of failures
1. good.....	2.8	13. dead.....	20.5
2. outside.....	3.5	14. sick.....	21.8
3. rich.....	3.9	15. loud.....	25.1
4. thin.....	8.6	16. happy.....	28.1
5. big.....	12.1	17. glad.....	34.2
6. empty.....	13.6	18. like.....	38.7
7. light.....	14.3	19. cheap.....	46.1
8. black.....	14.3	20. friend.....	50.6
9. white.....	15.2	21. many.....	57.1
10. quick.....	15.8	22. war.....	60.4
11. tall.....	16.4	23. false.....	71.6
12. above.....	18.6		

From this it appears that there was little advantage in changing *white* to *black*. *False* proved to be the hardest word on the list with 71 per cent. of failure, while *cheap*, which Healy has

put in its place is well toward the end of the list with 46 per cent. failure. *Dead* is somewhat easier than *like* for which it is substituted.

As *false* and *war* are the hardest words on the list, a study was made to see what would be the effect if credit were given for these two words. Table 60 gives the result.

60. TABLE SHOWING INCREASED NUMBER WHO PASSED WHEN GIVEN CREDIT FOR THE HARD WORDS FALSE AND WAR

MENTAL AGE	Number tested	Number successful anyway	Number made successful when false and war were allowed	Total now successful	Per cent. previously successful	Per cent. now successful
VIII.....	24	1	1	2	4.2	8.3
IX.....	153	14	5	19	9.1	12.4
X.....	162	35	20	55	21.6	34
XI.....	154	81	22	103	52.6	66.9
XII.....	45	34	2	36	75.5	80
XII+.....	63	42	4	46	66.6	73
XV.....	16	15	1	16	93.7	100

Further study shows that of all persons asked to tell the antonym of "*false*," only 58 succeeded, and 55 of these were over twelve years old physically. Mentally the largest number fell at XI years, although not a single one was eleven years old physically. In other words, the idea involved in *false* could be treated by XI year children if they knew the word, but this word comes into the vocabulary relatively late, and persons must be thirteen or more years of age before they can be expected to know the word *false* in relation to its antonym. If 75.5 per cent. of XII year persons can pass the antonym test with all the present difficult words in it, it would not be impossible, by substituting somewhat easier words for those of greatest difficulty, to make a list of antonyms which would be distinctly a twelve year test.

Value of the Test.—The test is one for which a ready use of the English language is essential. Where no language difficulty exists the test is a valuable one, since it deals directly with mental content, with the ability to repress irrelevant ideas, and to maintain a definite train of thought. It calls exclusively for abstract thought which accompanies mature mental development.

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